Dear Delta ISB members,

The subset of the Delta ISB preparing the water quality review has received 23 responses to the questionnaire we sent out, and several of the agencies have asked to be interviewed in person. Attached is a summary of the information from the responses to that questionnaire. We are sending it to you without any of the analyses that we will be doing, and we certainly are open to any suggestions that you may have.

We really want to thank Annie Adelson and Val Connor for all the work that they did on this--their efforts will certainly improve the review.

We are scheduled to discuss this briefly on the Friday of the October Delta ISB meeting, but we'll have more to report at the November meeting.

Sincerely,
Tracy, Liz, and Vince

ISB Water Quality Questionnaire Results

Respondent entities (in alphabetical order):

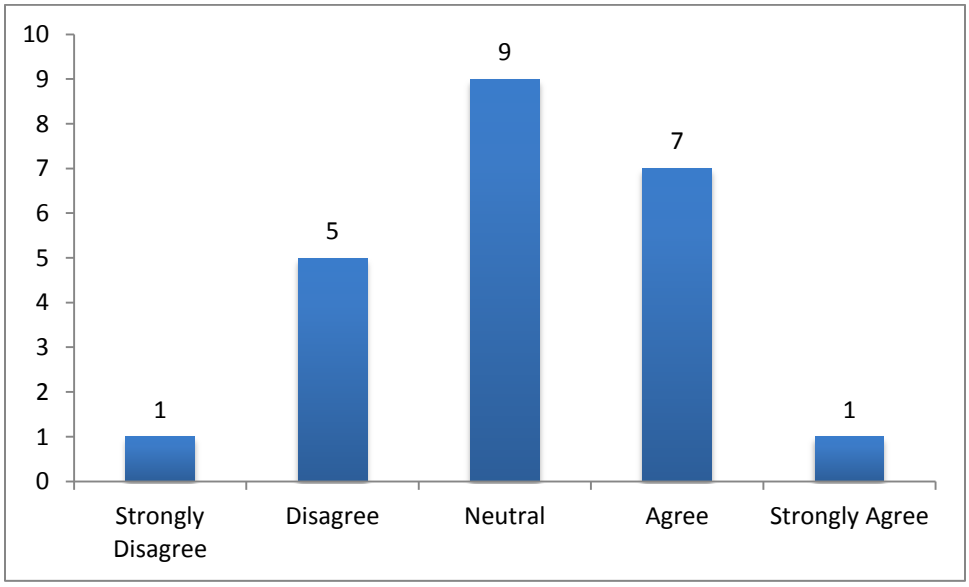
- California Department of Fish and Wildlife, Water Branch
- California Department of Water Resources
- California Department of Water Resources, Municipal Water Quality Program Branch
- California Parks and Recreation, Division of Boating & Waterways
- California Water Quality Monitoring Council
- California Water Quality Monitoring Council
- Contra Costa Water District
- Delta Science Program
- Irrigated Lands Program, Central Valley Water Board
- NOAA Fisheries
- Sacramento-San Joaquin Delta Conservancy
- San Francisco Bay Regional Water Quality Control Board
- Solano County Water Agency
- State and Federal Contractors Water Agency
- State Water Resources Control Board, Division of Drinking Water
- State Water Resources Control Board, Office of Information management and Analysis
- State Water Resources Control Board, Pesticide Permitting Program
- US EPA Region 9
- US Geological Survey
- US Geological Survey, California Water Science Center

SURVEY QUESTIONS AND RESPONSES

I. A quick survey

Our goal is to develop an understanding of how water quality is currently viewed and managed in the Delta. For this review, the Delta ISB is not considering salinity, temperature, or dissolved oxygen, because the scientific understanding of these attributes has a strong basis already. For this review, we are focusing on chemical contaminants (including mercury, methylmercury, selenium, and pesticides, as well as other chemical contaminants such as pharmaceuticals, personal care products, and contaminants of emerging concern), nutrients, and drinking water constituents of concern. Please keep these attributes in mind as you consider the following questions.

1. The water quality parameters currently being measured in the Delta are the most important ones, and few if any additional measures are needed.



2. If you think additional parameters are needed, please list them here. Or, if you think fewer parameters are needed please describe which you think are superfluous.

- Sucralose
- Physical WQ paramenters are fine, perhaps more real-time data, but contaminants and nutrients are lacking
- While the list of parameters that have been monitored in the Delta is large, many of the constituents are monitored specifically for different projects. It is difficult to know what parameters are currently being monitored for, or whether the projects' schedules have ended. In light of that, some of key parameters that require more monitoring include the fate, transport, and ecological impact of sediment bound contaminants (e.g., pyrethroid pesticides and mercury), pharmaceuticals and personal care products, and the long-term toxicological

effects (cumulative) of altered water quality. The Delta RMP has severe funding limitations, which requires project managers to limit monitoring to only select constituents, inadequate spatial and temporal distributions, or both.

Toxicity testing, as well as, other evaluations of xenobiotic impacts to aquatic life physiology, behavior, etc. is not adequate to support timely management decisions. For example, it is widely known that contaminant impacts to fish populations are primarily sub-lethal (e.g., documented fish kills are rare); however, water quality objective development for the CVRWQCB pyrethroid TMDL relies on acute toxicity data because data for chronic impacts is lacking. Furthermore, no current long-term stable monitoring for pyrethroid pesticide impacts exists. Pyrethroid pesticide use has increased greatly over the last few decades, and CA DPR has rank many of them as posing the greatest risks in California.

Adverse impacts to aquatic life (e.g., LC50s, reduced fecundity) have been observed at pyrethroid concentrations 2-5 times lower than analytical methods can quantify. Chronic toxicity testing could be used to evaluate pyrethroid pesticide impacts until analytical methods are improved. The Delta RMP conducts aqueous toxicity testing at 5 locations monthly; however, only USEPA 3-species tests are used. USEPA 3-species tests are likely inadequate to fully evaluate the impacts from pyrethroids because these 3 species are not as sensitive to pyrethroid toxicity as many native Delta species. For example, mysids and amphipods are invertebrates that are very important to the Delta food web, and they are found to be the most sensitive organisms to pyrethroid toxicity. Toxicity tests are available for these organisms, but they are not routinely conducted in the Delta. Likewise, other constituents will require the testing of additional species types to adequately evaluate their impacts to the aquatic ecosystem.

Overall, contaminant and toxicity monitoring in the Delta requires more consistency and thoroughness, and the studies need to be developed so they reflect impacts to key estuarine species.

- Pesticides and other chemicals at low levels are not being assessed adequately for sublethal effects or additive effects as stressors in concert with other stressors. More than just measurement of chemicals, effects on organisms past standard chronic and acute testing should be done. These include gene expression work tied to vigor and health, and behavioral effects in lab controlled studies for chemicals present in the system. In Vivo studies allowing actual exposure to various relative surrogate organisms at the boundary conditions of Hood and McCuen stations should be conducted as opposed to discrete grabs, since the watershed sources provide a complex temporal mix of pulses of contaminants. The boundary conditions represent the greatest amounts of chemicals. Special studies of actual in delta island discharge is important but should not be weighted in effort the same as the massive watershed contributions. Tools like the CoPST model has already developed and future investment should be found to update the model should help guide the selection of pesticides and the temporal and spatial focus of analyses.
- More data is always better. What about MWQI monitoring at all urban intakes including the City of Stockton's intake

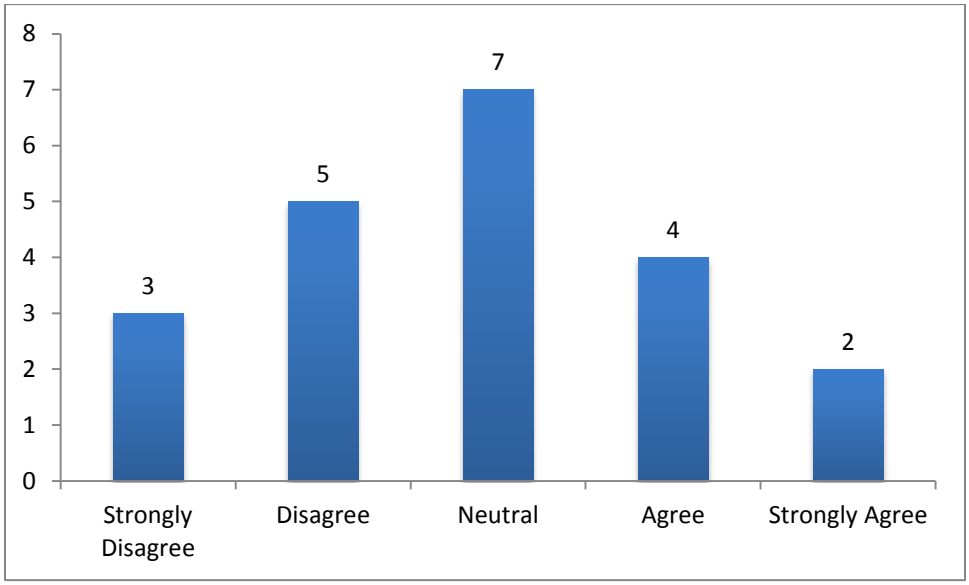
- FDOM (Organic Carbon), Pyrethroids (Pesticides), Chlorophyll-A
- methlymercury, pesticides, pharmaceuticals, nutrients, algal toxins
- The current use pesticides needs to be monitored in the Delta for a numerous years to account for spatial and temporal trends and where there are concentrations above the appropriate benchmarks, then the source and pathways need to be understood. We need to examine potential water and sediment toxicity with a diverse suite of test species. The DPR priority model should be used to determine the pesticides to be monitored in the system along with knowledge based information.
- Metals, e.g., cu, ni, which are naturally occurring and have anthropogenic sources, not because of water quality concern but to help understand presence and sources of other pollutants of concern
- Personal care products, hormones, and pharmaceuticals
- HABs/algal toxins, contaminants and toxicity (some is now happening through Delta RMP, but it isn't sufficient yet), microbes. If you are focusing mostly on chemical constituents, you may not be including microbes in this review, but that's the problem - they rarely get included anywhere/by anyone, even though they are enormously important ecologically and for public health.
- Not knowing the actual water quality parameters which are currently being measured in the Delta, I cannot respond accurately.
- Thinking of in situ data, the main issue is that we aren't making good use of the data we do collect. But I'd like to see targeted in situ ammonium and phosphate; stratigically-placed continuous sensors that provide information about phytoplankton size and rudimentary taxonomic class; multi-wavelength fluorescence sensors that permit tracking of wastewater. But, perhaps most importantly, sensors that can actually see the main HABs we have here. As pointed out by Will Stringfellow many years ago, you can put a conventional chlorophyll fluorescence sensor in what is obviously by eye a big microcystis bloom, and you can get a response of 2 or 3 ug/L chlorophyll; we are testing the theory that the newer small optical volume sensors cannot see the colonies that comprise HABs. Thus, we are hampered in our ability to relate HAB inception to flow and WQ conditions.
  Toxicity testing and the other biological tools available that assess the health of organisms or biological effects of exposure are highly underused. Biological testing helps understand the dynamic, combined effects of multiple compounds present at any given time. Chemical analysis alone is often problematic because of unknown bioavailability, but toxicity testing innately provides the answer to whether or not something is bioavailable.

  PPCPs and neonicotinoids are rarely evaluated. Phenylpyrazoles like fipronil have been detected in the region, and they are known to be more toxic as they degrade, yet special studies are the main source of monitoring for them. Adjuvant compounds are rarely monitored as well. PBO is the prominent adjuvant analyzed in special studies, but it's mainly used with pyrethroid insecticides. We don't know what others are used for other chemicals. In addition, important

supplementary information like TOC/DOC are rarely collected for the purpose of evaluating the toxicity of contaminants found.

- It is likely that additional agricultural pesticides and other CECs need monitoring
- Consistent sampling for contaminants would be an important addition.
- For drinking water purposes, existing monitoring captures most of what is needed. Additional monitoring and better availability of toxic algal bloom data would be helpful - unclear at this time whether the recent programs will be sufficient to not only identify locations of blooms but provide enough data to predict blooms in advance. For ecosystem purposes, I suspect additional parameters may be needed, but this is outside my expertise.
- Hyalella and chironimous toxicity testing. CECs (pharmacuteciles and personal care products, flame retardants). Sub lethal fish effects.

3. The spatial and temporal scales at which water quality is being measured are appropriate for supporting management decisions.



4. If spatial and temporal scales are not adequate to support management decisions, please describe what parameters need to be measured at higher resolution. Conversely, if you think some parameters are being measured at higher density and/or frequency than needed, please say what those parameters are here and how they should be modified.

- No opinion
- depending on what you want to do and what your goal is-->modeling requires more. I dont think we are in a sitaution where any parameter is measured too much (at this point)
- Pesticides are monitored by the Delta RMP at only 5 input sites to the Delta monthly. The irrigated lands programs (within and upstream of the Delta) do not monitor for aqueous pesticides, except for maybe a few exceptions where TMDLs have been established (e.g.,

diazinon and chlorpyrifos). No monitoring is conducted to help understand the fate and transport of pesticides through the Delta. Likewise, data are insufficient to evaluate the cumulative impact of pesticides up the food web, as concluded by the POD synthesis report (Johnson et al. 2010).
Similarly, the Delta RMP only conducts aqueous toxicity testing at 5 locations in the Delta.

- For salinity and flow measurements are adequate which are in the permits. For toxicity and sub lethal effects there is inadequate spatial and temporal measurements. Discrete grabs do not adequately capture the heterogeneity of the system. Aggregate sampling, or more important bioassay work at the boundary conditions and sources should be conducted.
- Should have short periods of intense higher frequency collection of MWQI constituents to better understand tidal variations. Monthly sample is not going to provide that kind of detail.
- Pyrethroids (Pesticides) - More frequency needed during the wet season
- Pesticides (e.g., pyrethroids) should be measured at higher temporal resolution; nutrients fate and transport (nitrates and ammonia) and methlymercury production should be measured at higher spatial and temporal scales to identify when and where hot spots and hot moments occur, as well as what the drivers that influence the pools and fluxes of these constituents in the Delta.
- We need to test key indicator sites with a much higher frequency. We need to understand the tributaries which are the inputs to the Delta, such as Vernalis on San Joaquin River and Hood on Sacramento River. These are DWR stations that have real time for a flow, EC, temperature and a few ions. We should conduct more frequent sampling here to ascertain the major inputs to the system.
- Nearly all of the parameters that are the focus of this review suffer from a lack of consistent and adequate temporal and spatial coverage.
- I'm not adequately familiar with current spatial and temporal scales, but I know we have insufficient nutrients and CECs data. We probably can cut back on mercury and methylmercury monitoring given our understanding of their presence, sources, and management actions.
- Measurements need to be made at at higher frequencies at more flow stations to get at processes - a good long-term high frequency base monitoring network needs to be developed that should cover the entire estuary. Water quality parameter additions should be considered when new sensors become available - sensor technology is advancing rapidly. Of course, the data then also needs to be analyzed! Shorter-term, smaller, but more spatially intense HF monitoring networks should augment this base HF monitoring network to address specific questions of management concern, eg about the effects of the upcoming Sac Regional WWTP conversion or specific wetland restoration actions. Also, more attention needs to be paid
  Again, focusing on collection of in situ high-frequency data: before I would add parameters or stations, I would think about redirecting the current efforts. Between DWR and USGS, we have a good flow network, but we often do not collect water quality data at the same locations that flow is measured, which hampers our ability to correctly interpret that data. It seems to me that

it would assist the monitoring that is done by collection of discrete samples would benefit from sampling at the same locations we are collecting continuous data, but this is often not done.

We also have yet to make an effort to harmonize instrument calibration and data collection between the agencies that collect continuous water quality information in the Delta. There are a few major blind spots in the networks of water quality sensors currently deployed in the Delta, such as in the north-central Delta, where the effects of wastewater discharge are most acute because of the longer residence times possible there.

We are beginning to extend our networks of stations into the estuary, which is an exciting development.

I mentioned above that ammonium, phosphate and additional phytoplankton parameters were measurements that would help us better manage the system, but they should be deployed stratigically. They will help us assess in real time the effects of management decisions on aquatic food webs. The information that is available now is good, but it could be better focused on the specific elements of productivity that we are seeking to restore - diatoms and other larger phytoplankton - and avoid - HABs.

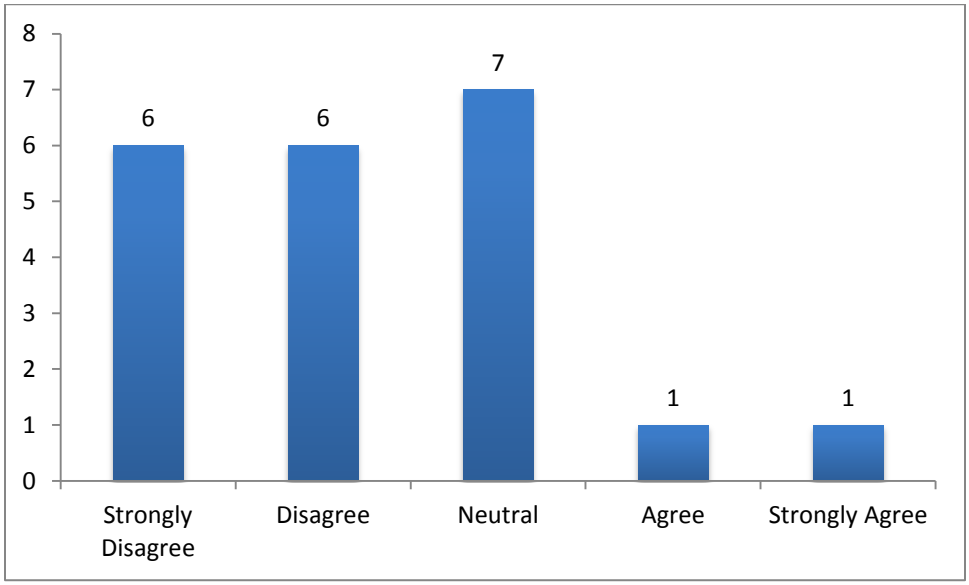
There are two parameters important to drinking water that also could be strategically added to help us understand water quality drivers. These are dissolved organic matter - which can often be measured by vicariously calibrating FDOM measurements - and bromide - which can be measured at relevant concentrations using the existing optical nitrate sensors.

- currently used pesticides, pharmaceuticals, and personal care products
  The Delta RMP is the umbrella program regularly monitoring contaminants in the Delta, yet they are focused on pesticides (as is the Irrigated Lands Regulatory Program) with some proposed future work on nutrients and mercury. They only monitor five peripheral sites coming into the Delta monthly and this is not sufficient either spatially or temporally. This doesn't provide enough information to perform mass balanced, identify sources and sinks, or generate trend data for quite some time.

  Additional frequency for SWAMP's SPoT monitoring would be beneficial. Their current monitoring frequency was deemed adequate for a relatively stable system, but the Delta is very dynamic.

  Legacy contaminants for which control programs have been in place for some time and show a decreasing trends could be monitored less frequently.
- It is possible that more monitoring in Delta receiving waters should be conducted (additional locations) and there are some pesticides that should be monitored more than once per month during their high use periods.
- Spatial and temporal sampling methodology needs to take into account the hydrodynamics of the system.
- Pesticdies and toxicity testing at high enough resolution to assess both local discharges and regional inputs.

5. Water quality in the Delta currently is sufficient to support the recovery of species listed as threatened or endangered under the Endangered Species Act.



6. If some aspects of water quality are hindering recovery, or are not sufficiently understood to determine if they might be hindering recovery of threatened or endangered species, please describe those aspects here.

- No opinion
- 2 areas that need exploring-->timing of first flush (and what's in it and what the effects are) as it lines up with migration, and spraying for aquatic veg and the effects of the spraying
- There are currently only about 10 water quality objectives or criteria for pesticides in the Central Valley, while over 1000 pesticide active ingredients are used in California. Pyrethroid pesticide used started in the Delta in the 1970's, yet the CVRWQCB is only now about ready to consider adopting a control program for them. Pyrethroid use in the Delta has been shown to explain 24-73% of the variability in IEP FMWT fish abundance indices. Recent pesticide runoff modeling predicts that herbicides and fungicides likely pose the greatest risks to Central Valley watersheds. This is consistent with USGS pesticide monitoring in the Delta, where herbicides are the most frequently detected pesticides. Herbicides likely reduce primary productivity in the Delta.

  USGS pesticide monitoring of the Sacramento and San Joaquin river inputs in the Delta showed that all samples contained mixtures of 3 to 14 pesticides. Pesticides reduce the benefit of the already limited aquatic life habitat in the Delta. Most of the Delta and tributaries are currently 303(d) listed for unknown toxicity, pesticides, and metals.

  Dissolved oxygen objectives (6 mg/L) in the Stockton DWSC were developed to be barely adequate to allow salmonid passage during fall-run adult migration. Much of the literature suggests that salmonid species need a minimum of 8 mg/L DO to prevent adverse impacts. In

addition, the WQO of 6 mg/L only applies to the months September to November. ESA listed species (e.g., spring-run, steelhead, or green sturgeon) migrating through the DWSC outside of this time window could be subjected to even lower levels of DO. Furthermore, many other water bodies in the Delta are still currently listed on the 303(d) list for impairments due to low DO.

Salinity objectives were developed to protect salinity sensitive agriculture. As a result the natural variability of salinity intrusion into the Delta has been decreased. Some research has suggested that the reduced salinity in the interior Delta has allowed the proliferation of invasive aquatic plants as well as possibly increase the occurrence of cyanobacterial blooms.

The POD has occurred concurrently with reduced phytoplankton and zooplankton abundance, which make up the food web. The cause of the decline of these lower trophic levels is unknown; however, some of the hypothesized causes include invasive clams, ammonia discharges from Sacramento RegionalSan or adjustments to nutrient ratios, and pesticide discharges. Monitoring will be necessary to partition the possible impacts of these and other factors to food web and fish declines.

Until about a decade ago, fish were thought to be insensitive to mercury toxicity; however, research has found that they are as sensitive, if not more sensitive as humans. A recent study has implicated mercury toxicity to Delta fish species. In addition, many studies have shown mercury toxicity to piscivorous birds in the Bay-Delta.

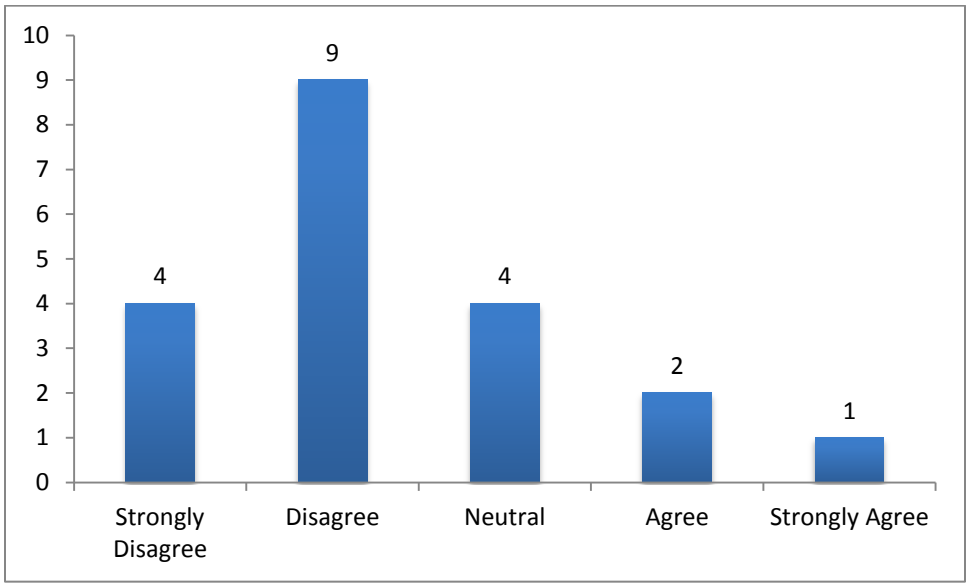
- the role of turbidity and smelt has been explored but not translated into management actions. Increased clarity is a major issue for smelt. Work in the Yolo bypass
  As discussed above, contaminants at sub lethal effects and as a co-occurring stressors to endangered fish is not understood in the Delta.
- Salinities are too high (e.g., to be able to wipe out the Asian clam) and contaminant concentrations are too low, i.e., not enough flow. Some argue that Dilution is not the Solution but starving the rivers and Delta estuary of flow through excessive exports, diversions to upstream storage, etc., exacerbates the contaminant concentration problem.
- Pyrethroid fate/transport not well understood, additional stations with Chlorophyll-A needed to better understand food availability.
- The impacts of current pesticides used primary in agricultural landscapes; pollutants in urban stormwater runoff; production of methylmercury as a result of land use disturbance, and pharmaceuticals are aspects that of water quality hindering recover. In particular, certain pesticides, as well as urban stormwater runoff have been shown to jeopardize the existence of federally listed salmonids and green sturgeon in the Delta and their designated critical habitat.
- We need to understand the interaction between flow, salinity and pollutants - how these have cumulative effects.
- Nutrients are probably the biggest water quality issue for endangered species recovery. Pesticides probably have more localized impacts but cumulatively may be important.
- sublethal effects (i.e. endocrine disruption) of pharmecueticals and contaminants of emerging concern should be evaluated more.

- Pesticides, nutrients, CECs
- I'm not really sure if I understand this question correctly - 1) is water quality itself good enough to support recovery, or 2) are WQ parameters monitored and understood well enough to support and assess recovery actions? Re 1): we know that sometimes, in some places, water in the Delta is toxic to test organisms which means it's likely one factor that's hindering recovery. What continues to be unclear because of insufficient monitoring is how widespread and severe (by itself, and relative to other stressors) this problem really is and how it affects the habitats favored by endangered species. We also don't always know what caused the observed toxicity. We know that HABs have become more common and widespread, but we don't yet have a good quantitative monitoring system in place to assess their severity and effects. And we still haven't resolved the role of different nutrients (especially ammonium and nitrate) in the system, including how they support the production of food sources relevant to endangered species. The Sac Regional treatment plant conversion provides an excellent opportunity to learn more, especially if the conversion could proceed in phases (first just conversion of ammonium to nitrate, then denitrification - I understand that this isn't currently the plan). Re 2) HABs, contaminants, tocxicity, and pretty much anything relating to microbes (bacteria and protozoa) aren't sufficiently monitored and understood. Processes such as nutrient transformations, transport, and fate aren't either. The role of these variables and processes in species declines or recovery thus can't be fully assessed.
- Not knowing the actual water quality parameters which are currently being measured in the Delta, I cannot respond accurately.
- It is my understanding that folks currently believe species declines in the Bay Delta are related to disruption in food webs consequent to a change in phytoplankton community composition. If we seek to restore these food webs, we need better information about them then can be obtained in weekly or monthly grab sampling programs. As I pointed out above, continuous monitoring of basic phytoplankton taxonomy and size distribution is possible with current commercial instruments, but needs to be attended by a robust grab sampling program for calibration.
- currently used pesticides, endocrine disruptors, harmful algal blooms, and nutrients and their effects on aquatic organisms and their food supplies
- I don't think we have the data to determine this, but we do know that whenever we look for contaminants, we find them. When we find them, they're either in concentrations known to negatively affect non-target organisms, or they're chemicals that we don't have effect concentration data for. We know that delta smelt are starving and they're supposed to fatten up during the fall and winter, in order to spawn in the spring, yet fall and winter are when contaminants that aren't pseudo persistent (e.g., pesticides) increase in surface waters. We also know that salinity, and to a lesser extent temperature, are being controlled, yet species continue to decline.

Whether contaminants helped shift the ecosystem to favor invasive weeds is yet unknown, but it seems clear that these weeds have increased clarity, reduced DO and flow, and provided cover for predators; all hindering the recovery of these fish.

- A better assessment of the risk of synergistic effects from multiple contaminants on sensitive species is needed.
- I have limited knowledge of whether water quality is hindering recovery. However, I believe that pesticides and other contaminants could be directly affecting species survival or the food resources that they depend on.
- We still have limited knowledge of the direct and indirect effects of contaminants on species and the food web. This is a knowledge gap. We currently do not have sufficient data to examine the extent to which contaminants are responsible for species declines.
- Pesticides and CECs having sub lethal or food web effects. Low DO in back sloughs. Also physical habiat and temperature are hurting resiliency (although I'm not sure these are "water quality).

7. Water quality in the Delta is sufficient to support overall ecosystem recovery, including important ecosystem functions.



8. If some aspects of water quality are hindering recovery, or are not sufficiently understood to determine if they might be hindering recovery, please describe those aspects here.

- no opinion
- 2 areas that need exploring-->timing of first flush (and what's in it and what the effects are) as it lines up with migration, and spraying for aquatic veg and the effects of the spraying
- There are currently only about 10 water quality objectives or criteria for pesticides in the Central Valley, while over 1000 pesticide active ingredients are used in California.

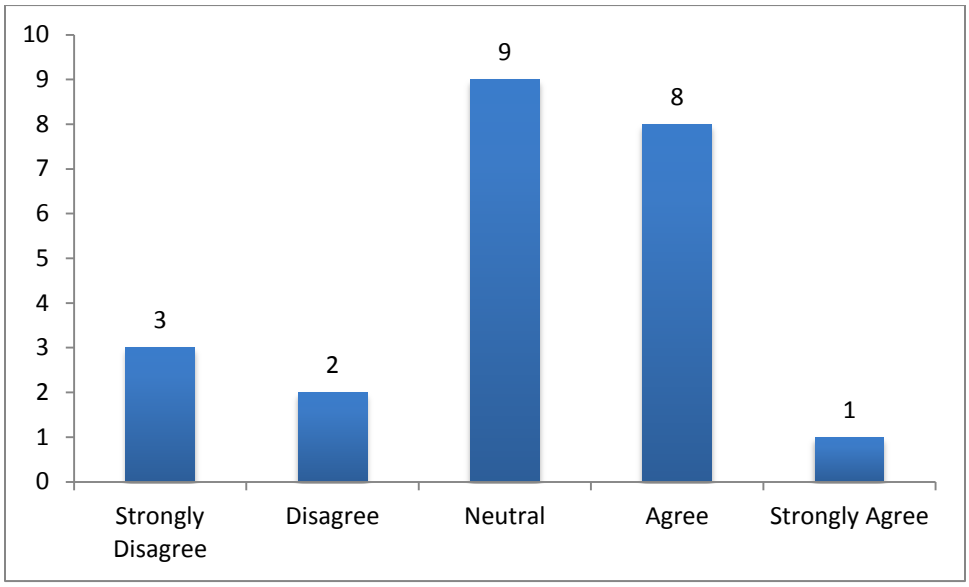
- Continued support of the clear water lake concept to maintain low salinity at the pumps has created an altered ecosystem that eliminates natural tidal flux. the loss of seasonal flooding of wetlands and subsequent drainage has created greater water clarity and loss of transported organic matter and food chain organisms. The lower estuary looks like a freshwater lake , not a tidal marsh Upgrade of the SRWWTP is under a long term time frame, allowing ammonia to be continued to be discharged at large amounts. The expansion of CyanoHABS and nutrient roles are not understood in the Delta.
- Salinities are too high (e.g., to be able to wipe out the Asian clam) and contaminant concentrations are too low, i.e., not enough flow. Some argue that Dilution is not the Solution but starving the rivers and Delta estuary of flow through excessive exports, diversions to upstream storage, etc., exacerbates the contaminant concentration problem.
- Pyrethroid fate/transport not well understood, additional stations with Chlorophyll-A needed to better understand food availability.
- Ecological function in the Delta is altered by dramatic changes in land use, such as increased pesticide application and nutrient inputs to salmonid bearing streams, that far exceed the rate of store or the ability of the Delta to 'process' this constituents. Some of the underlying aspects/mechanisms (hydrology, habitat, climate change) that drive these ecological processes are poorly understood. How do these drivers affect listed fish species and what are the effects at various level (sub-lethal); and spatial and temporal scales.
- Again, nutrients are probably most important.
- high nutrient load, eutrophication
- Pesticides, nutrients, potentially some CECs
- I'm not really sure if I understand this question correctly - 1) is water quality itself good enough to support recovery, or 2) are WQ parameters monitored and understood well enough to support and assess recovery actions? Re 1): we know that sometimes, in some places, water in the Delta is toxic to test organisms which means it's likely one factor that's hindering recovery. What continues to be unclear because of insufficient monitoring is how widespread and severe (by itself, and relative to other stressors) this problem really is and how it affects the habitats favored by endangered species. We also don't always know what caused the observed toxicity. We know that HABs have become more common and widespread, but we don't yet have a good quantitative monitoring system in place to assess their severity and effects. And we still haven't resolved the role of different nutrients (especially ammonium and nitrate) in the system, including how they support the production of food sources relevant to endangered species. The Sac Regional treatment plant conversion provides an excellent opportunity to learn more, especially if the conversion could proceed in phases (first just conversion of ammonium to nitrate, then denitrification - I understand that this isn't currently the plan). Re 2) HABs, contaminants, tocxicity, and pretty much anything relating to microbes (bacteria and protozoa) aren't sufficiently monitored and understood. Processes such as nutrient transformations, transport, and fate aren't either. The role of these variables and processes in species declines or

recovery thus can't be fully assessed- endangered species depend on a functioning ecosystem/ecosystem functions that support the reproduction, growth, and survival...

- My knowledge of the POD and other Delta issues is very limited, but I know the Delta's water quality is not sufficient to support overall ecosystem recovery.
- currently used pesticides, endocrine disruptors, harmful algal blooms, and nutrients and their effects on aquatic organisms and their food supplies
- There is reduced abundance of key species: some due to food web effects (as I explained above) and some to direct effects of contaminants (e.g., straying, inhibiting olfactory queues for ripe females and predators, reduced fecundity). The energetic cost of coping with contaminants can decrease food intake and this is particularly concerning for species already known to be starving. With insecticides able to reduce viable offspring 25-30% in amphipods and fish, and these compounds regularly detected in the Delta, it doesn't seem likely that water quality supports recovery. In addition, the 30% reduced fecundity observed in fish was from the estrogenic activity of an insecticide at very low doses. There is no accounting for the estrogenic effects of the many PPCPs in the system that would likely increase this effect.

  The effects of multiple compounds and the effects of these compounds combined with other abiotic stressors (e.g., increased temperature, increased salinity, reduced habitat range) needs more attention along with the sublethal effects that can lead to decreased abundance or genetic diversity.
- Methylmercury, heavy metals and pesticides are likely to be hindering recovery in addition to other contaminants.
- I have limited knowledge of whether water quality is hindering recovery. However, I believe that pesticides and other contaminants could be directly affecting species survival or the food resources that they depend on.
- Unsure of difference between this question and previous. We still have limited knowledge of the direct and indirect effects of contaminants on species and the food web. This is a knowledge gap. We currently do not have sufficient data to examine the extent to which contaminants are responsible for species declines.
- Same as above answer. The food web effects are not well understood. DO is too low in back sloughs and pesticide toxicity in some areas.

9. Water quality data are readily shared between entities.



10. If you feel that data sharing could be improved, please give suggestions, using specific examples if possible.

- My entity was unaware of HAB monitoring being conducted until just recently and they were not sharing the data with us. Many water suppliers have inadequate treatment facilities to deal with the algae problems experienced with the decreased flows in the California Aqueduct.
- support the WQMC and thier portals
- To share data means having a common way to link up the data geo-spatially. Therefore first order is a minimum geo reference standard and SOPs should need to be developed and required for each record so data can be connected in the real world.

  Second for years we have debated who's data base platform water quality data should be housed in. This has always met both personal and agency philosophy challenges and resources issues.

  Third, existing systems have vocabulary comparability problems for similar categories of data for example chemical name, or units of measure. The California Water Quality Monitoring Council l Portal for the delta has made great strides in bringing data together, mostly through the work of 34North and the interagency Ecological Program to integrate data into scientific visualization products.

  Technology advancements are allowing us to think differently. Open data platforms is the new and most promising approach. It allows groups to keep their data systems, but place data sets outside of firewalls for access by tools to integrate. Vocabulary challenges are being tackled by software that can look for compatibility with similar names and connect the values. Programs still need to have sustainable data systems that provide similar fields including the

above mentioned spatial reference data, and metadata as a way to evaluate the quality of the data.

Real time sensor data is on the rise and available publically, but data quality review of these large data sets and metadata describing the quality is problematic.

- Need a central repository that is more regularly updated. MWQI is good but QA/QC slows time for data to be posted. CDEC is real time but a big problem is that data gaps (due to problems with the radio telemetry) or "typos" are not subsequently added or correctly. For example, when the data are collected later directly from the meter, those data should be used to correct the real time CDEC data. What happened to the QA/QC database that IEP used to maintain?
- Data is not shared or easily available by (i) the Universities and (ii) local agencies. This is often a result of no readily available public platform to submit/upload this data to.
- To need to have a standard database. How do you combine data sets? Are the agencies using the same terminology? Like using open data platform. Need to have a good standard for exact location (lat/long).
- We don't do a great job with data sharing. For example, we don't have a very good way of accessing high frequency water quality data collected by Federal agencies.
- Sharing is increasing, particularly between Bay and Delta monitoring efforts for nutrients, but improvements needed to support nutrient water quality modeling. We could improve sharing of Bay CECs monitoring with the Delta.
- Our data is publically available on 2 web sites that DWR maintains.
- I feel there has been quite a bit of improvement in recent years. At this point, I think it's fairly easy to discover and retrieve available data. What's still less readily available is consistent metadata. Another good thing would be more data visualization or tools to visualize data on the fly presented along with the data, but there has been quite a bit of progress with this, too, e.g. by the CAWQMC.
- I don't have any suggestions.
- As I mentioned earlier, I think the first step should be ensuring that the data we all collect is comparable. We are trying to get workshop devoted to this topic funded. I know there is interest in the community.

  Data sharing is good and could be improved, but the CDEC program and portal does an outstanding job. The USGS NWIS program and portal is more difficult to use.

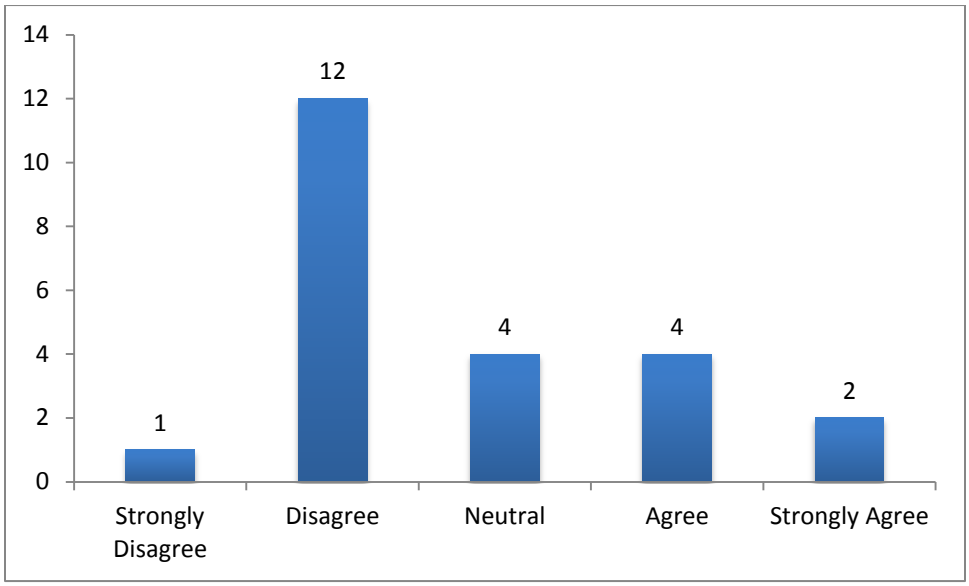
  The improvement that I would like to see is in data visualization. I know that SFEI is making progress on data visualization with their EnVis portal, and that BayDelta Live is working on visualization tools as well. But both are still well short of what is possible using commercial products designed for visualization of large and complex data.

  I believe centralization of Delta data in a single data warehouse and linking that data to powerful and flexible visualization tools would be a great investment, and speed our understanding of Delta processes.
- Creation of data management plans should become standard operating procedures for all monitoring efforts to ensure that data and metadata are properly managed and stored for

future use and access. Data systems need to be enhanced so as to make their data easily accessible and machine-readable via web services, open data platforms, and other methods. Metadata need to be included to document data quality and to allow users to determine whether data can be combined with data from other sources for broader and/or more in-depth assessments. A data federation of governmental water data could link together data systems residing in different organizations and programs, further improving access. An example of such sharing is the Water Quality Exchange developed by USEPA and USGS under the direction of the National Water Quality Monitoring Council. WQX combines water quality data from those two agencies, the US Department of Agriculture, and numerous states and tribes. All are made available through search tools and web services through the national Water Quality Portal (http://www.waterqualitydata.us). If all California agencies uploaded their water quality data to WQX, everyone would have easy access.

- Generally, groups seem to have less politically-induced inhibition when it comes to sharing WQ data than biological survey data, but how that data is shared needs facilitation. Often times, you still have to go to the data source rather than a database. Much of this data facilitation for WQ data has been lead by SWRCB efforts, but it doesn't include all the academic data generated nor does it include surface water data from permit monitoring (e.g., NPDES).
- is major room for improvement in this area but there has been substantial progress in agency recognition and commitment to data sharing. There The Delta Conservancy is implementing a project to improve data sharing: http://www.sfei.org/sites/default/files/biblio_files/2015_DEDUCE%20SOE%20Factsheet%20web.pdf
- This varies depending on the group, and whether they have their data readily available via the internet (e.g., via website, portal etc.). Much of the water quality monitoring data collected by various agencies are not readily available via the internet. Variable access to data exists across agencies and departments. One of the goals of the Monitoring Council has been to try and help facilitate access of those data via the MyWaterQuality portals.
- There have been both qualitative (visual ID) and quantitative measurement of microcystis in the Delta over the last couple decades. However, the data often comes out in papers years after the event - summarized rather than providing details that would allow additional analysis. Any projects funded by the State should require that the data is made available (not just the publications).
- not sure exactly what the should be done.

11. There is considerable duplication of effort in water quality monitoring in the Delta.



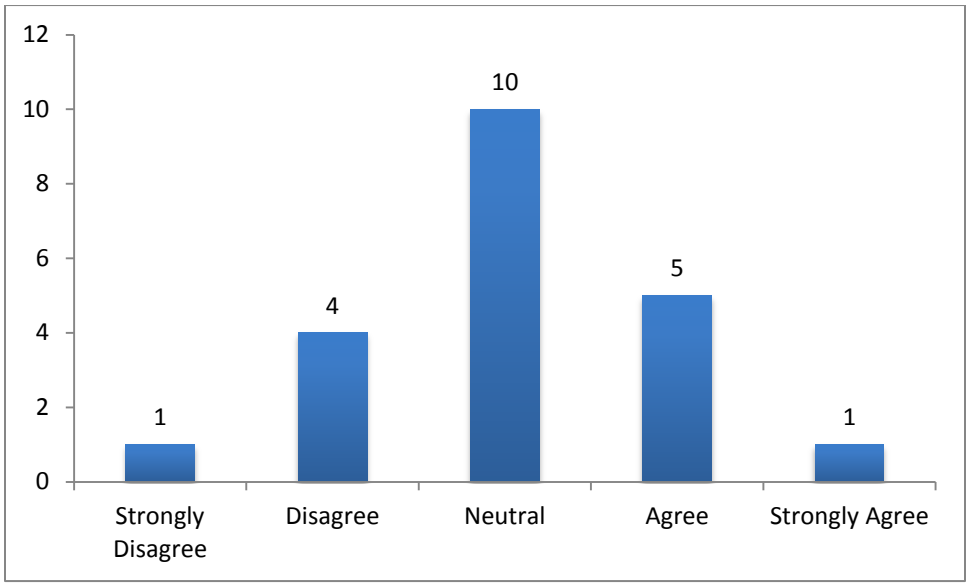
12. If you know of water quality monitoring efforts that duplicate others, or where efficiencies could be found, please suggest those here.

- no opinion
- yes, i know of them, but i wont waste your time on nitty gritty details---you should focus on providing a platform for discussion and information exchange so that it doesnt conitune to happen
- This is a reoccurring fallacy I have heard about all monitoring programs across the state. The point is each entity develops Data Quality Objectives based on mandates and management questions, and these determine frequency, location, data quality, and parameters. Rarely do these match someone else's needs. Some of the categories include research, compliance, and ambient for trends, with each one requiring different specifics. Money and resources are limited so those who connect through common groups such as IEP try and collaborate. outside researchers as well have been accommodated where possible, with samples taken and shipped to other researchers or room made during the sample run. Universities not on contract to IEP and others who don't bother to coordinate through IEP may collect overlapping data, but as mentioned above research is very specific, discrete, and not necessarily exchangeable for other monitoring data sets .

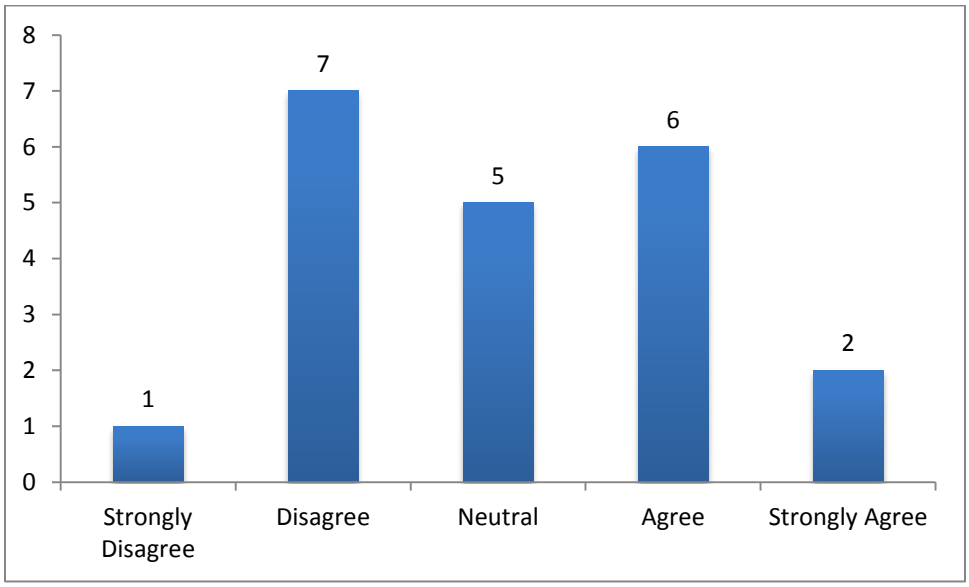
  Making data compatibility and required submittal into designated data system a condition of Federal and State funding would help bring in this outside data.
- If there is some duplication of EC data in the Delta that is probably a good thing because a Reclamation meter near a DWR meter sometimes gives a different value.
- The various state databases at DWR, State Board (SWAMP), State Board (Drinking Water), State Board (Waste Water), etc. are not cross-linked and most are not even easily searchable.
- This is rarely an issue in my experience.

- I'm assuming there may be some, but level of duplication << additional monitoring needs.
- There is redundancy throughout the Delta for some WQ constituents by different State & federal agencies.
- There is some duplication, but I actually find some (but not too much) redundancy to be a good thing. I think a bigger problem is inefficient coordination of field runs to service moored stations. For example, I think often individual instruments instead of all instruments housed at a station are serviced. This is because in many cases, stations have instruments belonging to different groups with different protocols. Cross-training and more coordination and collaboration could help.
- Wastewater treatment plants which discharge to the Delta could perform regional instead of individual monitoring. Watershed permitting and regional monitoring should be exhausted to the extent possible.
- Again, focusing my answer on collection of in situ continuous data, I think there is some duplication but not much.
  I think one of the problems that leads to duplication of effort is that different data collection efforts are on very different sources of funding. So, if a manager needs to ensure that they have a good long-term data set at a specific location, they need to locate a station there even if there is already a station operated by another entity, because they don't know how long the other station will be operating. Also, there are issues of data comparability, but we are seeking to address those as I described above.
- There is inadequate knowledge of who monitors what, when, and where. An interactive online system, such as the Central Valley Monitoring Directory (http://www.centralvalleymonitoring.org) would help in this regard, if it were maintained.
- There is so little contaminant monitoring, I no longer see the duplication there once was. Many might propose that contaminants monitoring should be added to the IEP EMP monitoring, but IEP is primarily in the larger channels, and as we know from the historic contaminant studies, contaminants need to be studied farther upstream with today's tools.
- There are some instances where there could be improved coordination and reduced redundancies. For example, DWR and USGS have some water quality monitoring stations that are nearly in the same locations. There could be improved coordination to try and minimize these redundancies.

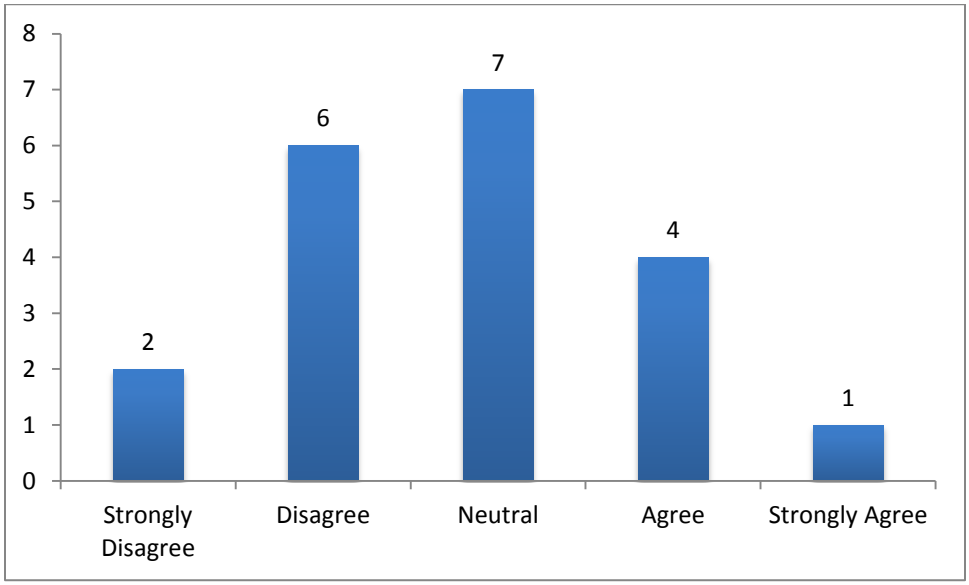
13. Water quality entities in the Delta collaborate on site selection.



14. Information obtained from compliance monitoring is being used in decision-making processes in the Delta.



15. There is integration among physical, biological and chemical monitoring programs (or efforts) being conducted in the Delta.



16. If you disagree, please recommend ways that integration could be improved.

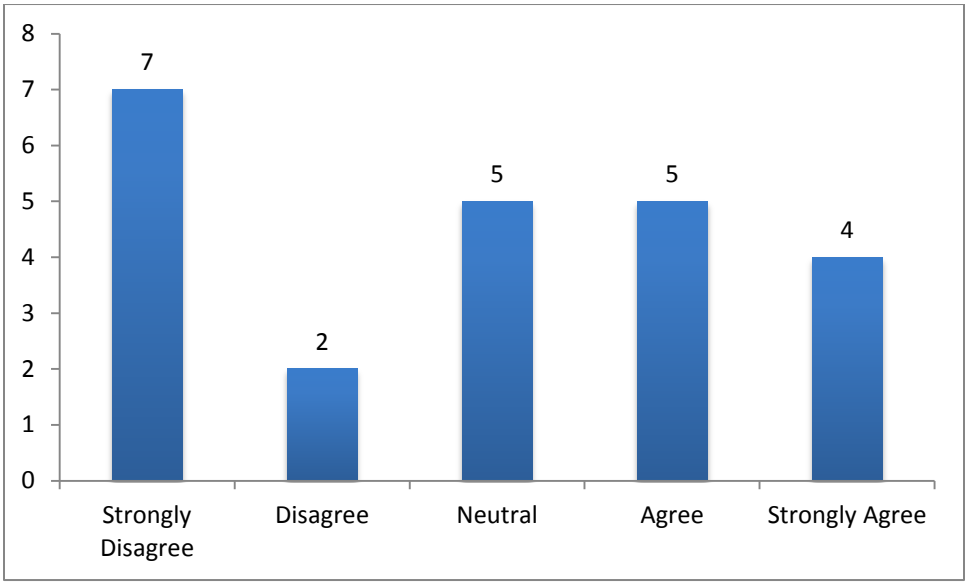
- more synthesis efforts like IEP's MAST (those take time and money though and we dont have it)
- Top down management direction.
- Agencies and programs tend to naturally be siloed. It takes time and effort to coordinate and integrate. The way to counter this is to present cohesive strategies on answering priority management questions in the Delta. This requires buy -in and agency or entity management commitment to the process. This can be done by addressing and prioritizing regulatory information needs, then grouping like purposes and missions. Workteams or study groups are then formed based on the grouping. Within each work team individual program's mandates and needs are discussed and recognized. Resulting study efforts are designed to meet as many of intersecting information needs, recognizing that some may not be met by an integrated monitoring or study effort and will need to exist outside the coordinated effort. There still should be a data connection where information can flow. Work teams need to include the appropriate multidisciplinary members- such a biologists, , geologists water quality experts and data management resources
- (1) Continued support of cross-discipline workshops like the Bay-Delta Conference, (2) a public data repository for local agencies or universities to submit data, and (3) development and support of a easy to use searchable WQ platform that links to the share repository and various State/Federal databases.
- Need to have good discussions and recommendations about 1) timing of samples evaluated (coverage over a range of seasons) to capture the breadth of potential chemicals, 2) location of the samples in relationship to the discharge from point sources and the runoff from agric, MS4,

3) sample type (for example is grab or composite more representative in relationship to frequency of the parameter). These are just a few considerations to discuss the representatives of the samples and locations + plus what monitoring tools to be used to evaluate effects and exposure.

- Internet access for all Delta data that will allow for data federation.
- I'm not familiar with the degree of integration but I'm assuming improvements are needed and available. If it doesn't exist, a user-friendly, go-to web site that accounts for and tracks all monitoring programs would be ideal.
- There is some duplication, but I actually find some (but not too much) redundancy to be a good thing. I think a bigger problem is inefficient coordination of field runs to service moored stations. For example, I think often individual instruments instead of all instruments housed at a station are serviced. This is because in many cases, stations have instruments belonging to different groups with different protocols. Cross-training and more coordination and collaboration could help.
- Wastewater treatment plants which discharge to the Delta could perform regional instead of individual monitoring. Watershed permitting and regional monitoring should be exhausted to the extent possible.
- As I mentioned earlier, my recommendation is that our continuous monitoring network form the backbone of the monitoring that is conducted in the Delta. This means that the data collected at each network node is comparable to all other network nodes, and that grab sampling is conducted at network nodes. This is only partially the case at present.
  I am certainly not representative, but integration, to me, comes when you're using the data for an analysis. As I've said above, I think we do far too little of that in the Delta.
- Again, data need to be better shared between programs in a machine-readable manner. See my comments above. Ambient monitoring data and regulatory compliance data should be used together. Data quality needs to be better assessed and documented to ensure that quality data are being collected. Monitoring and analysis methods need to be standardized to the degree necessary to be able to combine data from multiple studies. The Surface Water Ambient Monitoring Program and the work groups of the California Water Quality Monitoring Council have made strides in this area.
- Representatives from USGS, DPR, SWRCB, the ILRP, and IEP are participating in the Delta RMP, but their monitoring performed outside of the RMP is not well integrated with the monitoring under the RMP. Much of this has to do with the processes under which monitoring decisions are made for each of these programs and the types of questions they are trying to address. WQ sites don't match well for direct comparisons of other biological (e.g., IEP) data.
  There is only application data for professional (ag and urban) pesticide applications, yet loading doesn't give you presence in surface waters. There isn't enough data on the presence in surface water to understand fate and transport. Most of the WQ datasets available are short-term, and don't pair well with IEP's biological data.

- Integration might be improved by having a third party evaluate the monitoring programs, make recommendations for better integration, and facilitating discussions among monitoring entities.
- In some cases, the integration is great. In other cases, I read papers on water quality that lack recognition of the physical processes and misinterpret the data because transport and mixing are neglected.
- DWR S. Delta monitoring program needs to coordinate with RMP and IEP. There are probably several other ways. Ideally things should be more coordinated but its not sure which entity should, possibly CWQMC.

17. I am very familiar with the California Water Quality Monitoring Council's (CWQMC) actions in the Delta.



18. With additional resources, could the CWQMC be the best group to coordinate water quality monitoring programs?

- No opinion
- yes, it could
- Possibly
- Not for the Delta. The council is a great platform for allowing multiple entities to address statewide issues, such as data quality, data sharing, and emerging problems such as CyanHABS. The portal approach for the Delta is a good platform for access and visualization.
  I Believe IEP is the best entity but water quality issues in the ecosystem are under-represented in the IEP study design, which is decided largely by fisheries and food chain biologists. Additionally the Water Board water rights Division scientific participation technically needs to be stronger, since flow and salinity are often brought up in the hearings, versus other potential water quality issues. Therefore, IEP Directors need to recognize the importance of water quality

in ecosystem studies commit to including more water quality expertise and integration into their studies. Additionally, data management has been poor and inconsistent across the multi agencies of IEP. DWR management commitment to applied database needs at IEP for water quality and biological data bases has been under resourced for years and based on ACESS data platforms. This needs to be better. USGS groups receiving any State or Federal Delta money for Delta or watershed work needs to be held to providing data into designated systems in a more timely manner, not only their NWIS system.

- Possibly, but can it consolidate and/or be a shared platform for all of the various WQ programs in the Delta?
- I am more familiar with the efforts of the Delta Regional Monitoring Program Group. This maybe a function of my current role on the board, however I think a group that is 'Delta' focused instead of state-wide might be the best group to coordinate a water quality monitoring program for the Delta.
- With additional resources, there are several programs that could. That said, it probably makes sense that the CWQMC gets the resources, the legislative mandate, and the necessary authority to do this.
- It should be.
- Yes, if they would add links to DWR water quality and other agency's web sites.
- Hm... The CWQMC has a much broader scope than just the Delta and doesn't do any hands-on monitoring itself. A more Delta-focused group that actually does include hands-on monitoring might be better, eg the evolving Delta RMP or the long-established IEP. Also, WQ monitoring should be closely coordinated and integrated with all other monitoring in the Delta; I don't think the WQMC is in the best position to do this. The IEP is probably a better group for this. I think the CWQMC may have the biggest impact by bringing together and making all monitoring data available and visualizing and interpreting it in a publicly accessible way, and putting it in a statewide context. Another important role might be to guide and advise on WQ monitoring in the Delta.
- Currently, the Monitoring Council and its work groups operate largely on voluntary contributions of staff time and other resources. Even with this obstacle, the Monitoring Council and it work groups have made tremendous progress toward standardizing methods and bringing data and information together from multiple agency programs. The Estuary Monitoring Workgroup and the Wetland Monitoring Workgroup are key players in Delta data and monitoring coordination. Activities of the Estuary Monitoring Workgroup are coordinated with the Inter-agency Ecological Program (IEP). The California Cyanobacteria and Harmful Algal Bloom Network, and the Healthy Watersheds Partnership have also made progress in this area. The Monitoring Council's Data Management Workgroup and its recently formed inter-agency Steering Committee are developing options and recommendations for improved data management, data documentation and data sharing. Having dedicated resources devoted to collaborative efforts, such as these, could substantially enhance monitoring coordination, data documentation and sharing, QA, and coordinated assessment of Delta water quality data.

- Yes, but this would also require buy-in from other entities to participate and significant resources to integrate data or at least meta-data across programs.
- Yes
- Yes
- One of the CWQMC goals is to improve coordination of monitoring programs in the Delta and statewide. There are few (if any) organizations whose main purpose is to try and improve coordination of monitoring efforts (and access to data).
- I don't know enough to answer this. Possibly

19. If not, what is needed to make them even more effective?

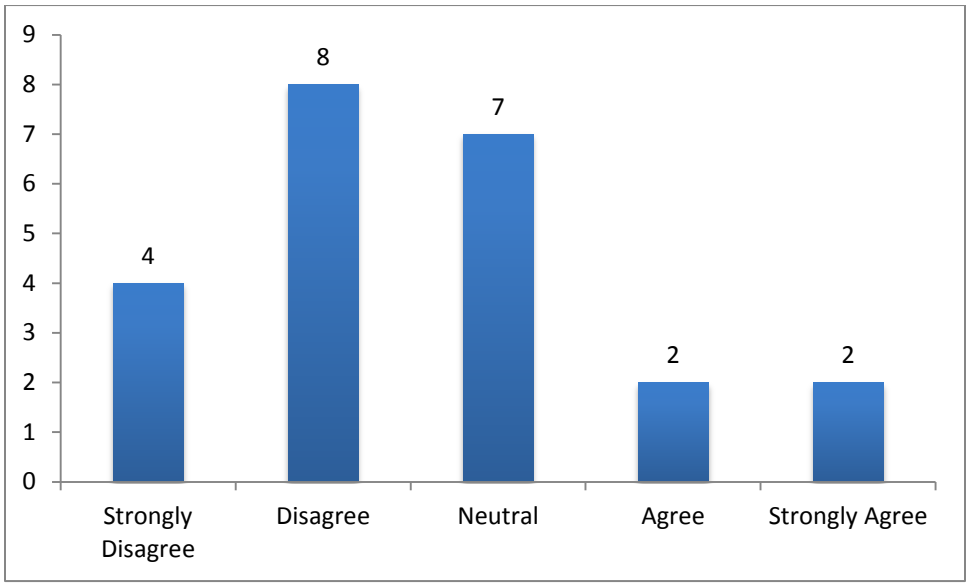
- the Council needs to focus on what they want to do--right now they are being opportunistic, which is good, but there needs to be a guiding strategy, and i think that is changing and a little unclear right now (likely b/c of a lack of funding)
- addressing data quality, and data system sharing, a well as open platform options might be a good role for the CWQMC. CyanoHAB crosses many agencies, so this is also a good role for the CWQMC.
- A Google search barely finds anything on the CWQMC. Clearly, there is much work to be done if this is to be a public WQ portal for the Delta.
- One suggestion might be increase coordination and engagement with natural resources agencies (fisheries), by seeking input on CWQMC monitoring program documents and initiatives. The board might include a representative from NOAA Fisheries on the Monitoring Council Member board.
- Need to have good discussions and recommendations about 1) timing of samples evaluated (coverage over a range of seasons) to capture the breadth of potential chemicals, 2) location of the samples in relationship to the discharge from point sources and the runoff from agric, MS4, 3) sample type (for example is grab or composite more representative in relationship to frequency of the parameter). These are just a few considerations to discuss the representatives of the samples and locations + plus what monitoring tools to be used to evaluate effects and exposure.
- Improved coordination and integration with Bay monitoring and management.
- Link to DWR water quality web sites.
- I don't think this is the best role for the CWQMC. Hm... The CWQMC has a much broader scope than just the Delta and doesn't do any hands-on monitoring itslef. A more Delta-focused group that actually does include hands-on monitoring might be better, eg the evolving Delta RMP or the long-established IEP. Also, WQ monitoring should be closely coordinated and integrated with all other monitoring in the Delta; I don't think the WQMC is in the best position to do this. The IEP is probably a better group for this. I think the CWQMC may have the biggest impact by bringing together and making all monitoring data available and visualizing and interpreting it in a publicly accessible way, and putting it in a statewide context. Another important role might be to guide and advise on WQ monitoring in the Delta.

- Dedicated funding is needed to allow each relevant agency to participate in the Council's work group efforts and resources to enhance data management, documentation, and sharing between agencies. The Council would be more effective if its membership were to be expanded to include additional governmental organizations that serve key roles in water quality and ecosystem health monitoring, assessment, and reporting.
- If not the CWQMC, IEP since their monitoring program is the largest and seemingly most restrictive (meaning changes to their program require more approvals and approval from an outside entity).
- Currently the Council only has 1.3 staff to work towards achieving the goal of improved coordination of monitoring efforts. Additional resources (staff and funding) would most certainly help to improve the Council's ability to work towards this goal.
- I don't know enough to answer this

20. If the CWQMC is not the best group to coordinate water quality monitoring programs, is there an entity that could better perform this function?

- IEP-with caveats above
- In general, state agencies struggle to implement programs. Unless there is a streamlined focus, plan, and timeline (and funding source) this effort will likely fail or be ineffective.
- Delta Regional Monitoring Program
- IEP but they need a better database system. They would need more contaminants experts, like aquatic toxicologists in their team. They are more fish centric.
- The San Francisco Estuary Institute and its information management and accessibility services could be better utilized.
- Delta RMP & IEP. A more Delta-focused group that actually does include hands-on monitoring might be better.
- Not to my knowledge.
- I don't know enough to answer this

21. Sufficient research has been done on water quality issues in the Delta.



22. If you disagree, please suggest where more research and what topics on water quality are needed.

- HAB's, contaminants, nutrients
- For the most part sufficient research has been conducted to show the importance of water quality impacts to the Delta ecosystem and organisms; however, there does not appear to be sufficient information for regulatory agencies to prioritize aquatic ecosystem health over anthropogenic interests. This may require numerical models to show that seemingly minor sub-lethal and indirect impacts to individual organisms can result in major population declines. Both numerical and conceptual models needed to help understand how sources, pathways, transport, mechanisms (e.g., biological, chemical, and physical), and other management actions (e.g., land use and sediment management) affect water quality.

  More research is necessary for nutrient (e.g., forms and ratios) impacts to the Delta ecosystem. In addition, the exchange of nutrients and food sources between the upper estuary, lower estuary, near shore, and floodplains is likely necessary to support species recovery. Understanding how to maximize these exchanges of nutrients and primary and secondary production in these zones is necessary to improve the Delta ecosystem health.

  More research is necessary to understand the role of reduced turbidity (or increased water clarity) on Delta species declines; whether it has been caused by reduce sediment inputs, reduced phytoplankton growth, increased submerged aquatic species, increased residence time (sedimentation), etc.; and, whether it can and needs to be mitigated.

  More research is necessary to determine the impacts to individuals and population from the interaction of contaminants and other stressors (e.g., altered temperature, predation, and mixtures).

- Sub lethal effects, additive effects of contaminants in the Delta. In vivo exposure studies at boundary conditions. Lab studies of threshold effects of related contaminants. Gene expression and behavioral effects. Contaminants of Emerging Concern monitoring. Determining relative sources of contributions of pesticides (Ag islands versus upstream watershed loading)
- Need to make people more aware of the State and Federal antidegradation statutes and the 2009 Delta Reform Act language linking the inherent objective of improving water quality in the Delta to the coequal goals. Also need to make people understand that there are times when there is good water quality in the Delta and those periods of very low salinity, etc., need to be preserved. CCWD relies on periods of high quality water (chlorides less than 50 mg/L) to fill Los Vaqueros Reservoir for later use as blending water when Delta salinities are high. The scary thing is that CCWD has signed a settlement agreement with DWR regarding WaterFix. This will enable DWR and Reclamation to export more water without regard to the CWF's impact on reducing the periods of good water quality in the south and central Delta. CCWD is not the only entity that depends on good water quality in the Delta.
- Understanding the fate and transport of Emerging Contaminants (i.e. hormones, medicines,..), Pyrethroids, and other constituents from urban storm water runoff into the Delta.
- There is much to learn about the impacts of pesticides, nutrients, algal toxins, and methylmercury in the Delta. Questions to consider include: What drivers and/or mechanisms influence the fate and transport of these constituents. What are the impacts to listed fish and their habitat? At what temporal and spatial scale should be measure these constituents to support fisheries and aquatic beneficial uses? How does land use change (habitat restoration) play a role in supporting the ecological function of the Delta? Can we restore the healthy function of the system by studying 'only' these constituents; do the information we collect fix within a broader framework? What are the hot spots and hot moments at which these constituents occur and can we use this information to drive management decisions?
- We need to fully understand the sublethal effects (from whole organism to molecular level) of contaminants and the interaction of chemicals + say a water quality stressor. What is that interaction of say the fish is starving bc of inadequate food quality and supply, so what happens when they are exposed to a chemical stressor or immune disease? The system is a series low level effects that cumulatively they have an adverse effect. EPA had conducted an in-situ study at Hood on Sacramento River (see Biales, et al. 2015). Biales A, Denton D, Breuer R, Riordian D, Batts A, Crane D, Schoenfuss H. 2015. Assessing Complex Watersheds Using Multidisciplinary Approaches: A Case Study in the San Francisco-Delta Estuary. Integrated environmental assessment and management. 11(4) 674-688. We need to continue this type of work.
- We have a way to go to really understand water quality impacts in the Delta. We don't have a good understanding of pesticide impacts in much of the Delta, especially locally around the fringe of the Delta. We don't really know how nutrients affect aquatic weed growth or the food web.

- Pesticides, particularly additive and synergistic adverse effects of multiple pesticides and degradates; nutrients; and CECs, some of which may have additive and synergistic adverse effects with pesticides and pesticide degradates.
- OC trends from the Stockton deep water ship channel, and OC and nutrient aconcentrations and loads from restoration projects in the N Delta.
- Phytoplankton community structure, size and productivity; Beneficial phytoplankton bloom inception, propagation and transport; Harmful phytoplankton bloom inception, propagation and transport; Nutrient forms, sources and sinks; Wetland nutrient utilization as well as phytoplankton and dissolved organic carbon evolution; Non-phytoplankton sources of energy available to Delta foodwebs; Wastewater effects; Nutrient uptake and transformation rates in both pelagic and benthic environments; Nutrient and constituent exchange that occurs when water is circulated through Delta peat islands; Mixed effects and interactions (e.g. temperature and contaminants, zooplankton feeding rates and contaminants).
- There are many compounds detected in the Delta that we still don't have effect data for, and we really need to understand the mechanisms behind effects before we can surmise how to address them and their effects on organism health.
- Additional research regarding the ecological effects of contaminants and nutrients is possibly needed. The need for additional sediments in the Delta is a topic that needs more research - especially the composition and size of sediments needed for aquatic organisms. Suspended sediments versus bed sediments.
- Hyalella and chironimous toxicity testing. CECs (pharmacuteciles and personal care products, flame retardants). Sub lethal fish effects.II. Questions specific to your entity

II. Questions specific to your entity

23. Describe in broad terms whether, and how, you use an adaptive management approach in collecting water quality data and how you use it to inform management decisions.

- i am bound by a mandate that doesn't have adaptive management in it (yet)
- Only for our Office- not presuming the Entire Water board

  Yes we do - we are under-funded to conduct a true statistically supported ambient monitoring program Therefore our sites and study selection has to be adaptable and reactive. for our BOG program we monitor mercury in sports fish. The information is passed to OEHHA and it is determined if and whir to post fisheries advisories. Became our data from past studies mercury concentrations do not change rapidly over time, we are rotating our sites over a 5 year period.

  Four our SPoT program, we look at pesticides in sediment. We look at emerging pesticides of concern and adapt our program to look for these potential emerging water quality problems

  Recently we developed a protocol for HAB sampling and analyses, that provide the data to lake managers and health officials, who can determine the level of posting needed.

- Yes, we use a simple Adaptive Management Approach. Data is first collected at key locations for a period of time, analyzed, and the program is then adjusted as needed to reflect the needs of our Agency.
- We use an adaptive management approach to actively conserve and protect ESA listed species and their habitat to meet recovery goals and objectives. We accomplish these goals through our coordination on regional monitoring efforts and engagement with various water quality state holders (state, federal, local, etc.). Our data needs and monitoring efforts are tied directly to the current and future threats to our species such as pesticides, heavy metals, sediment, etc; identified by NOAA scientist, biologist, stakeholders and the public. We use the data collected to inform our decision making process; to aid in identifying priority focus areas, additional data needs, and recovery actions.
- A good example of AM is the State Water Boards, SPoT program, contact Dr. Dawit Tadesse. This is a model that should be examined. They have a technical scientific review panel and input from entities. It has goals, assessment questions, very good analytical team and uses a diverse suite of test species to use to assess attainment of the assessment questions. They have reduced pollutants such as the OCs, PAHs, and at the same time looking forward to what pollutants needs to be included in next monitoring cycle based on the panel inputs too. Additionally, they are coordinating with DPR to have better coordination on focused monitoring to evaluate the effectiveness of management decisions, such as pesticide use restrictions (do they work?). This is the model to examine. Lastly, it is not political in nature like the Delta RMP (don't use this structure).
- We don't use it so much as we require it
- Most water quality data is collected for environmental compliance. Water quality data of herbicide residue is used to inform decision for herbicide application planning for invasive aquatic weeds.
- We drive Bay monitoring with specific management questions and form decision (answer) hypotheses using available data and information and adapt monitoring accordingly.
- We adapt to drinking water needs by DWR and to meet needs of the SWP Contractors funding my program.
- The USGS CAWSC - and the USGS in general - collects water quality data in a very systematic and consistent manner, with comprehensive internal and external methods and data reviews and documentation. At the same time, we are always working on developing and refining new methods such as continuous nutrient monitoring and detection and quantification of an ever-increasing number of pesticides. Water quality data collection is "adapted" to take advantage of new methods or better align with Delta monitoring goals, while at the same time assuring consistency over time. In the Delta, the CAWSC collects water quality data in support of adaptive and other management actions conducted primarily by our DOI sister agency USBR and by CDWR. One example is the 2011 Fall Low Salinity Habitat (FLaSH) study that was conducted in support of an adaptive management requirement in the 2008 FWS BiOp. Other examples are

flow, turbidity, and salinity data collections in support of daily water project operations and data collections supporting Yolo Bypass and other managed flow augmentations.

- NPDES permits have an effective term of five years. Dischargers under permits are required to reapply six months before their permits expire. During reissuance, permit writers evaluate the data collected in the permit cycle to determine whether additional requirements including effluent limits are needed.
- Primarily, we use our real time water quality data to identify conditions and events we seek to study. We look at the data every day and dispatch sampling crews if warranted.
- The Monitoring Council's Estuary Monitoring Workgroup is developing dashboard tools to bring together relevant water quality and aquatic ecosystem data to better inform Delta decision making. Such dashboards could be used to inform operation of water exports and other Delta operations. The Wetland Monitoring Workgroup is working with the Delta Conservancy to enhance the workgroup's EcoAtlas tools to track habitat restoration projects in the Delta and to assess their effects in a landscape context. The Data Management Workgroup is developing recommendations to enhace data quality documentation and increase data sharing between agencies, so it can be better used to inform adaptive management decisions.
- Most of our projects have been short-term, so the primary aspects we manage are for unanticipated difficulty sampling what or where was intended.
- The monitoring requirements for permittees in the ILRP are modified as needed in response to information gained from previous monitoring results (e.g., add or subtract constituents, sites, frequency). Water quality data is used to determine compliance with protection of beneficial uses and understand trends and problem areas.
- The Council does not serve this role.
- Adaptive management in collecting water quality data is not particularly relevant for our agency. We monitor what is required by law (i.e., even though we haven't found certain constituents, we must continue to monitor for them) and what is necessary to continue to deliver high quality of water to our customers. We adaptively adjust our operations and treatment processes in response to changes in Delta water quality, but we do not adaptively manage the water quality collection itself.
- We look at pesticide use data and current 303(d) listing status to see what should be moitored.

24. What data sources does your entity rely on to make management decisions? Does your entity collect the water quality data it requires, or does it rely on data collected by others?

- DDW relies on data collected by public water systems.
- our own data, IEP data
- Both
- Only for our Office- not presuming the Entire Water board We manage CEDEN and SWAMP databases, as well as CIWQS for NPDES. Mostly we use data from our programs.
- CDEC, MWQI and previously IEP. I also access water quality data from other DWR websites. My main focus is on the relationship of seawater intrusion (driven mainly by Delta outflow) and

other factors affecting EC, Br, Cl, Ca, SO4 etc. within the Delta. Adding new Delta facilities, such as the CWF's north Delta intakes, will change how seawater intrusion, San Joaquin inflows to the Delta, local drainage etc. combine to produce given concentrations of these parameters. There will also be a corresponding adverse impact on water quality due to other contaminants such as pesticides,

- Our Agency relies on data collected by USGS, DWR, and USBR and then collects our own data as needed.
- We use data from various sources which include the Regional Water Quality Control Board SWAMP and CAMP, Delta Regional Monitoring Program in addition to data collected by the CDFWS and the California Office of Pesticide Regulation. We rely on data collected by our agency and other agencies to inform our decision making process.
- We typically team up with entities to collect the data (see Biales 2015), this was a collective team (UCD, DWR, EPA) to do the work. We rely on DPR and State Water Board agencies.
- We rely on data and analysis done by others.
- My entity collects water quality data it requires.
- We rely on our collaborative Regional Monitoring Program and augmentations for TMDL development and our nutrient management strategy.
- We generate our own WQ data for drinking water concerns, but this may or may not be used for SWP operations.
- The USGS is a science, not a management agency. We provide data and information relied on by others who value the high-quality, unbiased data we produce.
- We rely on data submitted by dischargers covered by NPDES permits.
- My entity is not involved and regulatory compliance or management.
- The Monitoring Council does not make water quality management decisions and does not collect water quality data. It acts to improve the efficiency and effectiveness of water quality and aquatic ecosystem monitoring, assessment and reporting throughout California.
- We are not a resource manager, but try to inform resource managers with our studies. Our WQ studies have been special studies that primarily relied on its own data to answer the question(s) at hand, but have also used data collected by other entities to address specific questions.
- CEDEN and EcoAtlas. Our organization relies on other organizations to collect water quality data.
- We primarily rely on data collected by the Irrigated Lands permittees, but also use SWAMP, DPR, USGS data. We generally do not collect the data, but require the permittees to collect and report.
- The Council does not serve this role.
- We rely on our own monitoring as well as water quality data reported by others. For instance, we contribute funds for regular monitoring programs such as the USGS flow network and DWR's municipal water quality investigations program. Additionally, when something is spilled into Delta channels, we rely upon the OES reports and direct follow-up with the responsible agency to determine any impacts to water quality near our intakes.
- We mostly rely on others. We use data from DPR, USGS, Dischargers DWR etc.

25. Do you have water quality data within your entity that could be useful to other agencies but are currently not available to others who might be interested in it? If so, do you have plans to make these data available? If you plan to make these data available, how will you do it? What are the constraints in making these data available? In addition to more funding, what other resources would be most useful for enabling better data-sharing among users in the Delta?

- Yes, and Yes--constraints are a lack of funding for proper care and housing of the data
- For the most part, the water quality data collected in the Delta by the DFW are in coordination with IEP. These data are readily available through the IEP website. However, it is possible that water quality data are collected in the Department's other regions which are not readily available to others. The Department does not have the resources to coordinate the water quality monitoring that is conducted throughout the state. Additional funding and staffing may be able to allow the Department to coordinate water quality monitoring throughout the state.
- CEDEN provides surface water quality data from a number of sources. We are currently in the Phase 2 process to develop a more robust and consistent data base, and build advanced query tools to access the data. All our SWAMP data ends up in CEDEN. Eventually our permit receiving water data will also be there.
  My discussion of open data platforms above is relevant here. Also the needs IEP agencies to develop more robust data systems for the biological and water quality data.
- No
- Yes, we do have useful data that could be shared with other agencies. We do not have plans to make this data available. Constraints: (i) no easy-to-use public platform to upload the data, (ii) our data is collected to inform our Agency not to do scientific research, so it may not meet the academic standard, and we would not want to be bound to collecting the same exacting standards. The platform would need to handle different "qualities" of data (i.e. provisional vs validated, good data vs great data). Easy to use portal, something that could search for WQ via a Google Map type interface.
- Yes, as a federal agency we have data the is available to the public via open source and/or data base access. We have regulatory obligations to make sure the by data that is the best current available data collected and that it has undergone a QA/QC; which affects the timing at which data are release.
- No.
  We have water quality data available at a local level in relationship to areas of invasive plants treated with herbicide. Other agencies may find the data useful. Data is available by request. It is uncertain if there are plans to make data available through an online database for example.
  If there isn't one already available, it would be helpful to establish an online data catalog that had a comprehensive list of all data collection efforts in the Delta, complete with metadata and data download capabilities.
- All of our data are readily available via the SFEI website. We should have a concerted effort to better inform and enhance Bay and Delta data sharing.

- Our data is publically avilable on a daily and weekly basis.
- All our data has to be - and is - available to the public. This now also includes all research data in journal and other publications first-authored by USGS scientists which is made available through web data releases (see https://www2.usgs.gov/fsp/faqs_datarelease.asp).
- Discharger monitoring data in the State Water Board's California Integrated Water Quality System (CIWQS) are available to the public.
- All of our continuous water quality data is published in real time. We have a great deal of data that is associated with specific projects that is available if other parties are interested. We also routinely generate a great deal of "exotic" water quality data that would only be useful to parties that have a background with that sort of data. We make the data available when somebody asks about it. We are in the process of trying to routinely publish the data through the USGS ScienceBase portal but that is a work in progress. At the USGS, we are required to make our data publicly accessible to the extent possible.
- See responses above. The collaborative efforts of the Monitoring Council's workgroups have resulted in the development of a number of data sharing tools, including the My Water Quality portals (www.MyWaterQuality.ca.gov) and EcoAtlas (www.ecoatlas.org). Sufficient staffing to permit increased and sustained inter-agency coordination and the development of web services, data management plans, open data platforms, and data federations could greatly enhance data sharing.
- We have both data that our PIs hold and data we've required the PIs to load to databases like CEDEN or NWIS. We are a public entity, and more than happy to share our data with others. Our main constraint to this would be funding, and how we make the data available would be at the request of the entity housing or accessing it. The federation of data through web services and a website that identifies all those web serviced sources will be key to data sharing.
- No, but in the future if this becomes applicable we would use our Regional Data Center/CEDEN. Generally, we have found that constraints to making legacy data available include assigning a large amount of staff time to go through data that is difficult to enter into CEDEN templates because their may be limited information, including metadata that is helpful for entering data into the templates.
- Yes, we have a backlog of data that will be uploaded to CEDEN when the contract for the Regional Data Center is renewed.
- Representing the Council, we are not the primary data producers--we work to improve coordination and facilitate improved data access. However, constraints that are often encountered in our efforts include: 1) resistance to make data available via the web (for various reasons); 2) lack of resources and IT support to make data accessible; 3) low priority for management (due to time and resources to accomplish this goal). Creating a working platform to access data can be a considerable undertaking and requires staff time and resources (e.g. to develop web services, portal content etc.).

- We collect salinity data daily at our intakes, and this data is posted on CDEC in coordination with Reclamation and DWR. We have additional data that is collected monthly, but is not available online. We provide this data upon request.
- Yes we have some potentially useful historic data on pesticides and toxicity but have not got a plan to make it available. Its historic so not the highest priority.

26. If you are a manager, do you have a process for highlighting the science and research needs that would lead to improved management of water quality? Do you think that this is an important issue? If you currently lack a process for highlighting needs, what would enable you to do this process or to do it better?

- very important issue--I participate with IEP and WQMC, and as many other groups that i have time to collaborate with
- Because water quality regulations and management are primarily under the purview of the Water Boards, the Department often coordinates with Water Board staff to determine the kind of information they need to develop water quality criteria to protect natural resources. Yes, understanding and achieving the water quality conditions necessary to protect natural resources is important.
- The SWAMP roundtable and SWMP coordinators look at statewide issues of Water quality and direct SWAMP resources to address the issues. Additionally Agency wide issues also come to OIMA such as CyanHABS and CECs
- First develop tools and briefings to make clear that water quality is important and that the attitude of many big diverters that wet water is preferable to clean water (because wet less clean water can be treated later) is harming the Delta. After all, the multi-barrier approach to drinking water quality requires that source water quality be protected. The excessive diversions in the Delta and upstream have meant that the water diverted and exported and later used for drinking water purposes and farm irrigation is no longer of desirable quality. Education is the first big step. After that the big diverters may be more comfortable and caring about water quality in the Delta. Another example is the salt build up in the San Joaquin Valley. Reports by Reclamation and others talk about all sort of actions to avoid salt build up, but not increased flows to reduce salinity intrusion thereby reducing the salt concentration in water exported south into the San Joaquin Valley.
- Yes, but for a local agency like ours, the science and research is really focused on the local needs/requirements of our Agency.
- Yes, NOAA Fisheries leader in coordination with the Northwest Fisheries Science Center has developed a process to identify and prioritize pollutants that pose current and future threats to listed species and their habitat. Yes, this is an important issue. Healthy functioning of our water bodies is necessary for ESA-listed species conservation and recovery.
- Yes, Delta Plan, Delta Science Plan, and Science Action Agenda highlight science and research needs. Water quality is a legislatively required part of the Delta Stewardship Council - Delta Science Program responsibilities.

- We use our management issue/question based RMP and Nutrient Management Strategy to identify and pursue our science needs. Both have multiyear plans that are coordinated and are reviewed and undated annually based on management issues/questions.
- I work in the NPDES Program which implements adopted water criteria and objectives in permits. Staff in planning and standards development are better suited to respond to this question.
- The Monitoring Council currently has a limited role in managing water quality, focusing on improving the delivery of high quality monitoring and assessment data to inform management decisions.
- Our process is to bring it to the attention of our Board of Directors and other entities to see if collaborative efforts seem likely on priority issues. A tool we have to share our longer-term priorities during outreach with others is our Research Plan. Short-term priorities are shared through meetings. This is an essential way to identify possible collaborators. If a grid that identified the interests of various groups was regularly updated, it could facilitate this, but often there is sensitivity in sharing these types of information publically.
- Generally, no. It is important, but a bit outside of the scope and authority of our agency.
- We do this when we propose contract ideas and in various documents like the Delta Strategic Plan and various Basin Plan Amendments.

27. If you are conducting research, how are your research priorities in the area of water quality determined?

- mandates and biOps--meeting the requirements and then figuring out where the information gaps are
- The research priorities of our Branch are, in part, determined by the development of Water Board basin plan amendments or water quality criteria. The Department provides the scientific information to support the protection of aquatic and wildlife species (e.g., necessary water quality conditions to protect sensitive species, impacts of contaminant discharges to the ecosystem, and necessary flow volumes to maintain adequate habitat).

  Some priorities are determined by the Legislature, other statewide priorities (e.g., California Water Action Plan), or other agencies (e.g., Delta Stewardship Council).
- State wide and agency priorities, though we are mostly an ambient monitoring entity
- Fundamental priority is to protect the municipal and irrigation water supplies in Solano County. Secondary priority is to assess the risks that could impact those water supplies.
- We rely heavily on our scientist and staff biologist observation (via monitoring efforts, field and laboratory research to guide our research priorities. We also work closely with other stakeholders who are involved in water quality protection and natural resource management to identify constituents/contaminants of concern that impair water quality and effect beneficial uses.

- I am working with EPA ORD, State Water Board, and DFW to conduct field research on eDNA for multiple fish species in the system starting this winter for the next year. This work is part of a larger project for EPA.
- We fund research. We base our funding priorities on input from our partner agencies and synthetic efforts like the "State of Bay Delta Science".
- Research priorities are determined by permits and environmental compliance. Also, research priorities are determined by invasive aquatic plant effects and weed control program impacts to water quality.
- Our RMP and Nutrient Management Strategy decision making structure sets high-level priorities through their annual multiyear planning effort and utilize issue area workgroups or strategy teams of science advisors and local technical (informed) stakeholders to compile specific priorities and means to meet them.
- We are in constant communication with managers and scientists in other agencies who use our data and information and who work with us in collaborative projects. This helps us determine their research priorities and how they might align with our our agency, mission area, and center mission and goals. Since the majority of our funding is reimbursable, the needs of management agencies and collaborative opportunities drive a lot of what we do, but we cannot pursue research that is completely outside of our own mission.
- My research priorities are the most important questions in aquatic ecology in the Delta to which my research group can make a significant contribution. It is the overlap between the two that I seek to optimize.
- Various work groups of the Monitoring Council, including the Wetland Monitoring Workgroup, have conducted research to develop improved and standardized monitoring and assessment tools and methods, such as the development of modules of the California Rapid Assessment Method (CRAM) for different water body types. The work group collaborative structure, governed though work group charters, determines priorities.
- Our WQ research priorities are determined by our Science Manager with consultation from our Technical Team, Policy Liaison Committee, and Board of Directors. External peer review is also used for specific studies.
- I do not conduct research in my duties with the Council.
- Delta Strategic plan, knowledge of potential pesticide toxicity and use trends.

28. If you conduct research, what key uncertainties about water quality issues need to be investigated further, or what new research needs to be initiated?

- other people's QAQC--there is a lot of data out there, whether or not its useable is another question
- Population impacts to sensitive species from lethal and sub-lethal exposures to contaminants, direct and indirect impacts from contaminants, effects of mixtures of contaminants to the aquatic ecosystem, the impact of the interactions of physical (e.g., reduced acreage of habitat, temperature), biological (e.g., invasive species, predation, food web), and chemical (e.g.,

pesticides, nutrients) perturbations on organismal growth rates, individual survival, and populations.

- We need to have a more robust ambient program for CECs. possibly a topic for the CWQMC to take on. We are working with DPR to come up with a statewide strategy for storm water monitoring for pesticides and how to get ahead of the curve on effects of new use or expanded use pesticides. CyanHAB sources and environmental conditions leading to their blooms needs to be researched. OIMA has no marine monitoring program.
- Water quality related to the environmental health (or impacts to) endangered or threatened species like Delta Smelt or Longfin Smelt. Understanding the potential WQ stressors to these species is of particular importance.
- Below I provide a list of key research questions: What are the cumulative impacts of pesticide application to waterways with sensitive fish species? What are the direct and indirect; acute and sub-lethal effects of pesticides to fish and their aquatic habitat? What are the habitat effects of increased nutrient loading and algal toxins in the Delta. What are the hot spots and hot moments of pesticide; nutrient and methylmercury production in the Delta; and what are the key drivers? What modeling efforts are needed to improve our understanding of nutrient transport in the Delta; can we develop a nutrient modeling effort?
- At the moment one thing we are looking at funding is research into stable isotope methods that will help us understand the fate and function of nutrients from wastewater treatment plants in the Delta ecosystem.
- Do already established invasive aquatic plants provide a benefit to Delta water quality (i.e. via excess nutrient or contaminant uptake)?
- Better understanding of the fate and effects of pesticides, nutrients, and CECs.
- We are in constant communication with managers and scientists in other agencies who use our data and information and who work with us in collaborative projects. This helps us determine their research priorities and how they might align with our our agency, mission area, and center mission and goals. Since the majority of our funding is reimbursable, the needs of management agencies and collaborative opportunities drive a lot of what we do, but we cannot pursue research that is completely outside of our own mission.
- The high priority research needs I listed on the previous page pre-much capture the key uncertainties I think are important. I think what is missing in Delta research is a high quality integrated hydrodynamic and biogeochemical model.
- At a minimum, we need to start generating effect concentration data for the compounds known to be detected in the Delta, especially with Delta species whenever possible. More biological effect data through in situ studies and evaluation of sublethal effects is also a high priority. Then we can start performing non-targeted analyses to see if there are other contaminant issues on the horizon.
- Effects of CECs and relatively new pesticides on aquatic life.

29. What question(s) should we have asked but didn't? Also, your answer to any additional question(s) would be helpful!

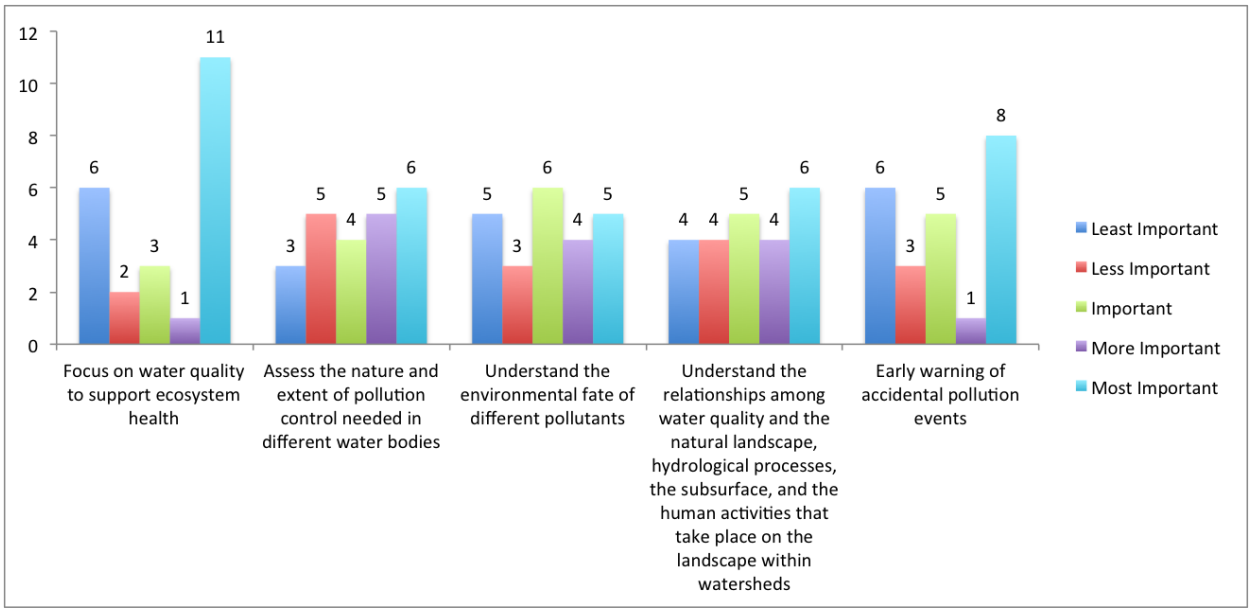
- Lets get serious about water quality. Up until this time only Contra Costa Water District has been really serious about Delta water quality for urban uses. The other members of the California Urban Water Agencies have been more interested in wet water and protecting their ability to export water, or are not invested in Delta water quality because they divert their water upstream of the Delta. Some, through CWF are hoping to also divest themselves from worrying about (protecting) Delta water quality by taking their water very close to the Sacramento inflow point to the Delta. Those that discharge wastewater or agricultural drainage into the Delta are also not interested in improving Delta water quality, which is why ACWA seldom fully engages in protecting Delta water quality. Unless this is solved at a policy / political level, there will never be enough support on a financial, technical or legislative level regarding water quality in the Delta.
- You might have asked how water quality data could be integrated with biological data. For example, data integration that will help understand the role of nutrients in the distribution and growth of aquatic weeds and harmful algae.
- There should have been regarding integration of Delta and Bay monitoring and studies. I answered several questions from that perspective, but input from other responders would be valuable.
- HAB, and public health risk advisories for HAB's in the Delta.
- I think in addition to the general questions, you could have asked some questions specific to some ongoing or intended management actions, e.g. WaterFix tunnels, specific habitat restoration projects, the Sac Regional WWTP conversion, Yolo Bypass, etc. For example, will these actions affect WQ in a part of /the whole Delta? Is the current WQ monitoring network sufficient to monitor and assess changes in WQ in specific parts and/or the whole Delta that may result from these actions? What monitoring and research is needed to determine if changes in WQ are due to these specific actions or something else? You could have also asked more about integration of WQ monitoring with the other monitoring activities in the Delta, especially flow monitoring (to get at fluxes etc), but also with other types of monitoring (physical, biological, to get a "habitat" rather than just "water" quality). And perhaps, since you asked "how good is Delta WQ," you could have also asked respondents to list and/or rank sources of water quality impairments, perhaps split up by point and non-points-sources. A question such as "how common is nutrient limitation of primary production" could also have yielded some interesting results since there are very different opinions about this out there. A similar "opinion poll" question about HAB or pesticide toxicity could also have been interesting. Also, a question more directly about monitoring that should be discontinued and/or done differently. Etc...
- To what extent would changes in the model for funding of monitoring and research improve management of water quality in the Delta? Are there opportunities for better integration of monitoring and research activities in the Delta? Can you think of an existing Delta monitoring

data set you would like to be funded to fully explore and prepare up publication describing the results?

- How will funding be identified for any newly proposed WQ monitoring? Is WQ a priority to address in relation to other ecosystem stressors? My answer to the latter is yes.
- None.
- Not sure if you consider temperature or physical habitat "water quality" but those are important and effect organisms resilience to other toxicants.

III. Needs of your entity

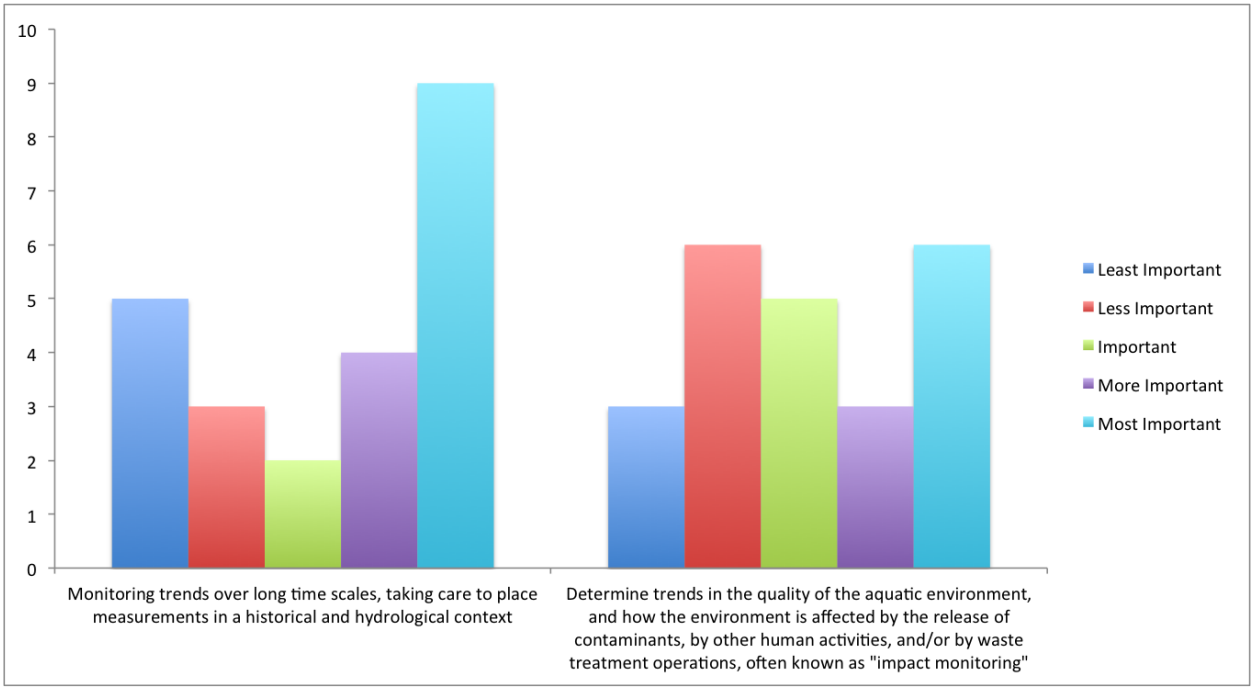
30. Ecosystem Health



Please list and score additional issues

- Water quality to support drinking water quality and public health. Water quality to protect recreation in the Delta (impacts on swimmers and boaters from water contact). Water quality issues related to environmental justice and public health (e.g., health issues from subsistence fishing in the Delta). The coequal goals talk about restoring the Delta ecosystem, but water quality is important for many other beneficial uses.

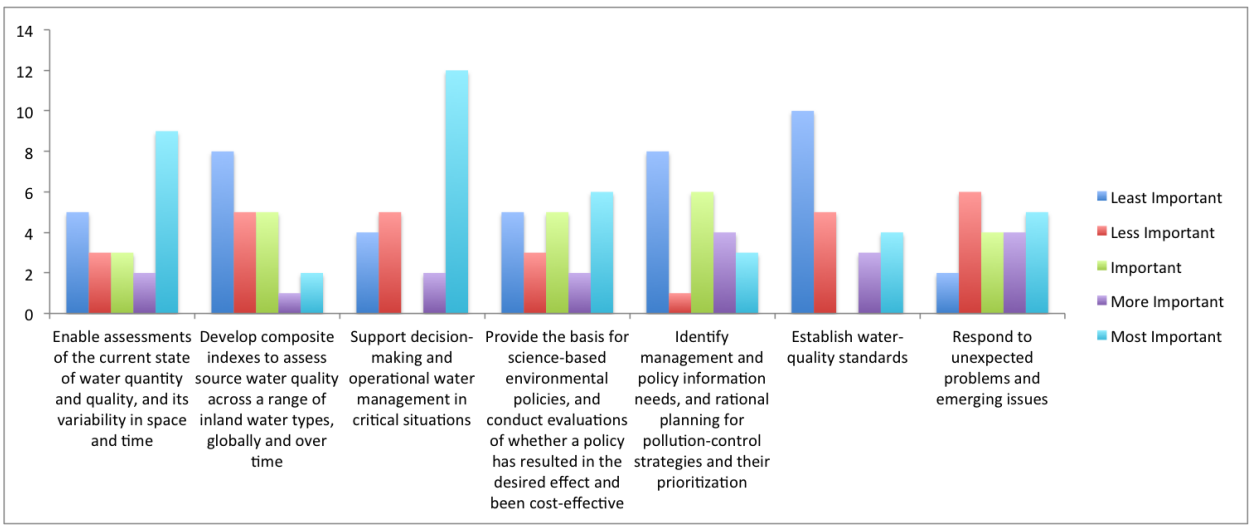
31. Trends in Water Quality



Please list and score additional issues

- Not sure what this question is asking? Is this related to my business or do I think these are important issues or not?

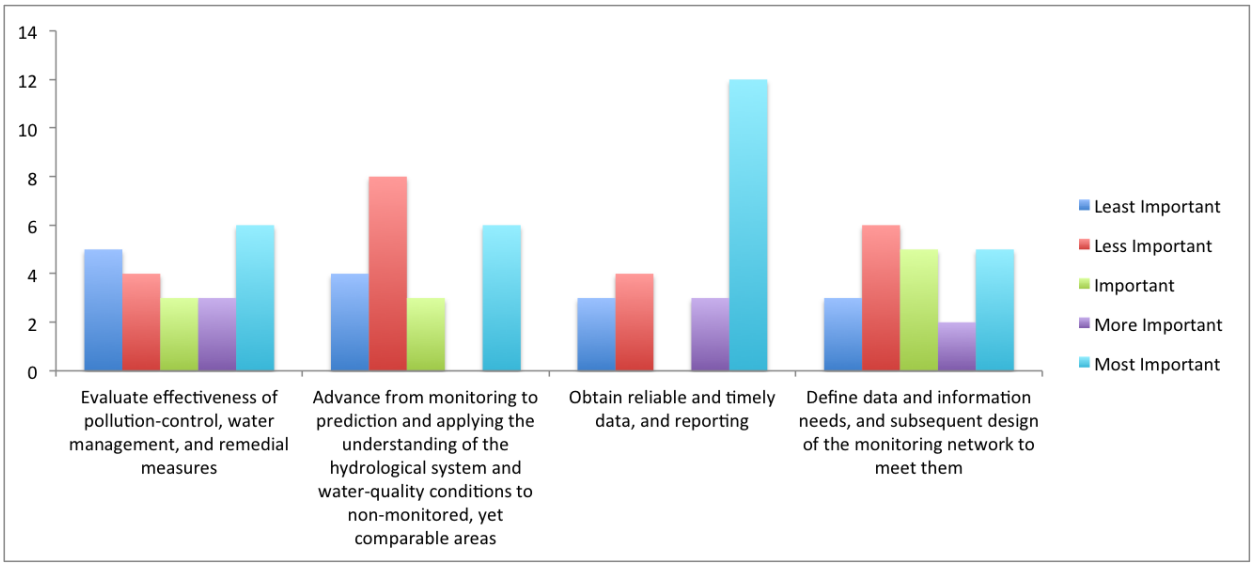
32. Decision Making



Please list and score additional issues

- Again - do not just focus on point sources of pollution or sources from runoff, but also look at how reduced inflows and outflows from the Delta have adversely impacted water quality in the Delta - less advection and dispersion of contaminants, increased seawater intrusion, higher concentrations of contaminants in the inflows to the Delta (because of lower flows), especially with respect to the San Joaquin River. Increasing flows on the San Joaquin (e.g., by requiring minimum flows based on a percentage of unimpaired runoff) will help restore the ecosystem of the San Joaquin and its tributaries and the Delta and improve water quality in the south and central Delta.
- That section on decision-making was a little difficult to score because it seemed as if you were ranking things that your entity did not do as unimportant, when they are important but it is simply that this is not the role of your entity.

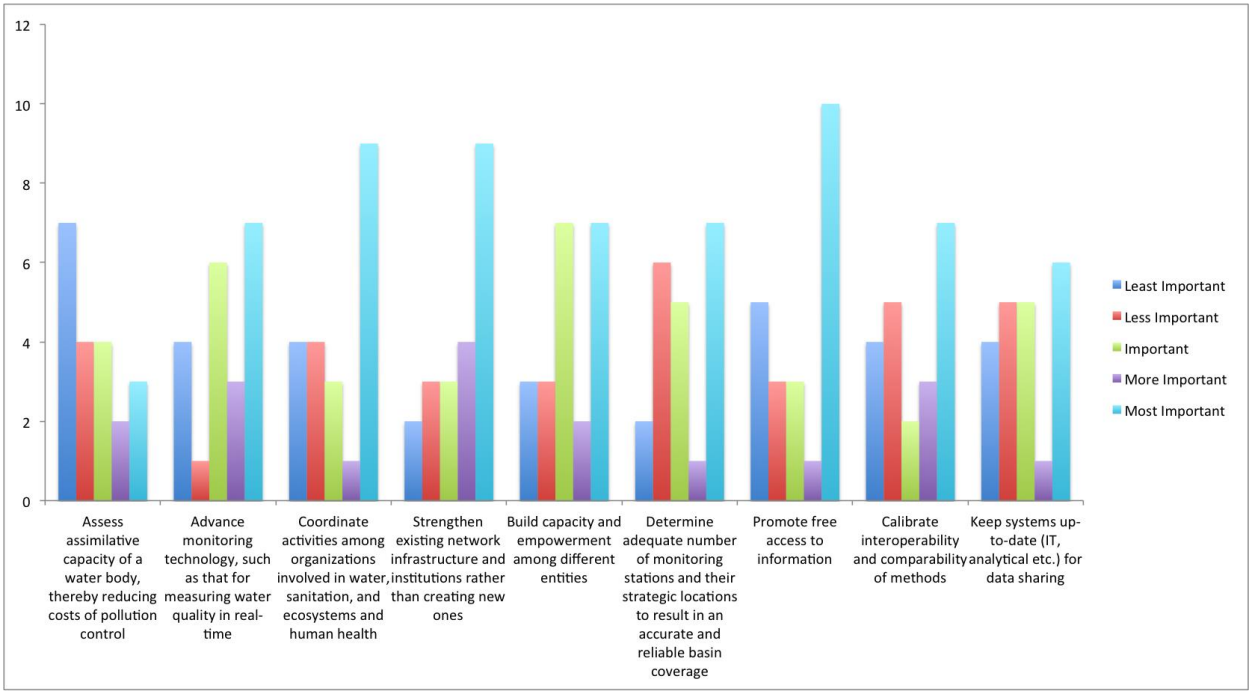
33. Outcomes



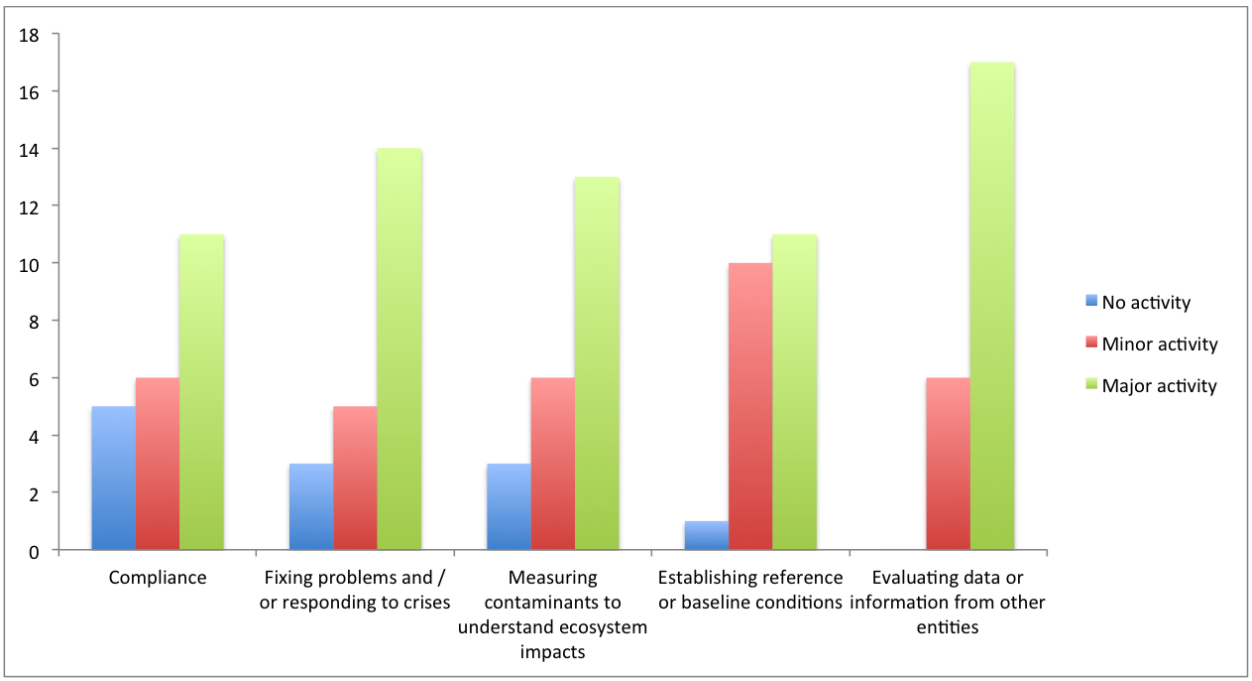
Please list and score additional issues

- That section on outcomes was a little difficult to score because it seemed as if you were ranking things that your entity did not do as unimportant, when they are important but it is simply that this is not the role of your entity.

34. Technical Development, Coordination, and Improvement



35. How would you describe the activities of your entity?



Please list and score additional issues

- FYI re Evaluating data or information from other entities: the CAWSC reviews a lot of data collected by others to satisfy FERC and other monitoring requirements ("furnished records") and then approves and publishes them in NWIS. However, to my knowledge, we do not do this with data collected in the Delta.

36. Please provide links to documents that you think would be useful in reviewing science in support of water quality in the Delta.

- www.sfei.org/rmp, www.sfei.org/rmp/nutrients#sthash.MB4QPj7S.OaMbxt74.dpbs, or http://sfbaynutrients.sfei.org/
- Uff, I don't even know where to begin, there are so many... Maybe I could take a look at your list at some point and add things that might be missing. I'm sure you already have things like this: http://www.water.ca.gov/iep/activities/reviews.cfm and papers such as https://profile.usgs.gov/bpeller/ and https://profile.usgs.gov/bbergama. And many more...
- Increasing Efficiency and Effectiveness Through Collaboration, First Triennial Audit report (http://www.mywaterquality.ca.gov/monitoring_council/docs/first_audit_report.pdf)
- A Comprehensive Monitoring Program Strategy for California (http://www.mywaterquality.ca.gov/monitoring_council/docs/comp_strategy_all.pdf)
- Monitoring Council Recommendations to Agencies (http://www.mywaterquality.ca.gov/monitoring_council/docs/sb_1070_full_report_final.pdf)
- Tenets of a State Wetland and Riparian Area Monitoring Program (http://www.mywaterquality.ca.gov/monitoring_council/wetland_workgroup/docs/2010/tenetsprogram.pdf)
- My Water Quality Portals (www.MyWaterQuality.ca.gov)
- Citations can be provided to support comments made in the technical section upon request.
- http://www.sfei.org/sites/default/files/biblio_files/2015_DEDUCE%20SOE%20Factsheet%20web.pdf
- http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions/index.shtml
- There are a large number of documents - I can discuss content, if needed.
- The 303(d) list, Don Weston and Jim Orlando's monitoring. (don't have time to find the links right now)